LIBRARY OF CONGRESS
NOV 20 1893

THE AMERICAN GAS LIGHT JOURNAL

REDMAN & KENNY, N.Y.

PUBLISHING OFFICE No. 32 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, VENTILATION, WATER SUPPLY AND DISTRIBUTION, & GENERAL SCIENCE.

VOLUME LIX.—No. 21. Whole No. 963. | NEW YORK, MONDAY, NOVEMBER 20, 1893. | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager.
JOS. R. THOMAS, C.E., Editor. T. J. CUNNINGHAM, Asst. Editor.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND CLASS MATTER.

Published on each Monday of the year, at No. 32 Pine Street, N. Y.

Terms of Subscription, Including Postage.—For the United States and Canada, $3 per annum. European countries, $4.50 (19 shillings—22½ francs). All payments to be made in advance. Single copies, 10 cents.

Remittances should be made either by post-office order, express money order, registered letter, or bank draft on New York, payable to the order of A. M. Callender & Co.

Collections are invariably made directly from this office, for subscriptions, advertisements, etc. We have agents to solicit the same, but they are not authorized to receipt for money.

The American News Company, Nos. 39 and 41 Chambers street, New York, are agents for this JOURNAL. Newsdealers will send orders to them.

Correspondence.—Wishing to make this JOURNAL a gazette of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, correspondence is solicited for publication from all who make the study of those subjects a pleasure or a profession.

Books.—We will forward by express, at publisher's lowest rates, any book—scientific or otherwise—to any address in the United States or Canada. We would suggest to our patrons that to avoid the risk and expense consequent on sending us the money (we do not send books C.O.D.), that orders for books be sent us through the Purchasing Department of the American Express Company.

The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

CONTENTS.

An Asterisk (*) denotes an illustrated article.

EDITORIALS—

Briefly Told 721

The Decision of the Massachusetts Gas Commission in the Chelsea Case—Retirement of Mr. George S. Hookey—Notes.

A Gas Man's Notes at the World's Fair, by F. B. W. 722

High vs. Low Temperature in the Cracking up of Oils, by Mr. R. S. Moss 723

Salomon's Process of Obtaining Hydrogen and Carbonic Acid Gas 725

Petroleum Mining at Mendoza 725

Effects of Strain on Machinery 726

New Gas Wells in the Pittsburgh District 726

The Proposed Amalgamation of the Russian Petroleum Industry ... 726

Coal in Western Sweden 726

*Appendix to the Paper on Gas Engines in the American Market, Read by Mr. F. H. Shelton before the American Gas Light Association 727

ITEMS OF INTEREST FROM VARIOUS LOCALITIES 731

Mr. Taylor Takes Charge at Bay Shore, L. I.—The U. G. I. Company Compiles a Pamphlet—Vallejo (Cal.) Electric Light Company Insolvent—Opposition Franchise for Kansas City, Mo.—Annual Meeting, Harrisburg, Pa.—Mr. Dunbar in Charge at New Rochelle, N. Y.—"Gen." A. B. Campbell and the Franchise at Topeka, Kansas—The Iowa City, Iowa Election a Failure—Public Lighting, Modesto, Cal.—The Canisteo (N.Y.) Electric and Fuel Gas Company—The Dunkirk (N.Y.) Gas and Coke Company Chartered—Something about the Early History of the Consumers Company of Toronto—Cheaper Gas for Augusta, Me.—Natural Gas Combination—Text of the Decision of the Commission in the Chelsea Case—The Brooklyn (N.Y.) Board of Aldermen and the Lighting Contract—Memorial Minute to Mr. Wm. Combe, Society of Gas Lighting—The Decision under the Lyford Act—And Other Items.

The Market for Gas Securities 734

BRIEFLY TOLD.

THE DECISION OF THE MASSACHUSETTS GAS COMMISSION IN THE CHELSEA CASE.—A notable case (possibly the most delicate one that has occupied the attention of the Massachusetts Board of Gas and Electric Light Commissioners), recently decided on its merits by the arbiters of the gas business of the Bay State, is that which sprang from the petition of certain gas consumers of the Chelsea district, who urged that the gas supplied by the Chelsea Gas Light Company was not only deficient in quality but was too high in price, even admitting that the quality was up to the legal standard. The consumers prayed the Board to interfere and regulate the matters complained of by the necessary decrees, whereupon hearings were held, the evidence was sifted and the Commissioners have formulated their verdict, which declares that the quality of the gas was all that it ought to be, but that hereafter it shall be sold at 15 cents net per 1,000 cubic feet less than the old price—or at $1.65 instead of $1.80. The full text of the decision is given in our item columns, and it is well worth the careful perusal of everyone interested in the gas business, since it goes far to show that the only Commission of the kind in the country is fairly fulfilling the ends for which it was created—a board of appeal which stands as an honest arbiter between the sellers and the purchasers of a commodity that cuts an imposing figure in the commerce of the State.

As earlier remarked, we consider the Chelsea case to have been an extremely delicate one for the Board to handle, because it is only something like two years ago when that body was called upon to interfere in the same direction, and then, as now, the net result was against the Gas Company. In 1891 the Board had good, solid ground to go upon in ordering a reduction, for the rate of $2 per 1,000 was concededly a high one, too high in fact for the conditions governing the trade there. We imagine there will be no dispute over the fact that, in *any* city or town of Massachusetts where the annual sendout reaches 30 millions cubic feet per annum, gas at $2 per 1,000 would mean that either the Company so charging was making an undue return to its shareholders, or that its business was being conducted in an extravagant manner. This would be the natural inference at the first glance; and either horn of the dilemma would be sufficient to goad the consumer to the point of actual complaining. However, the Board, after patient hearing and unbiased reflection, came to the conclusion in 1891—and it reiterates the same thing in 1893—that the real trouble with the Chelsea Company is not in extravagant management, nor in an incapable administration of its works' or office departments, but rather in the thrifty (?) acts of its proprietors in the good, old days, who, only seeing the sunshine of present prosperity, piled up a capital out of all proportion to the earning power of the business volume that could be safely depended upon. In fact, their action seemed to indicate that the days of high prices were to prevail forever. Comparisons, of course, are far from being infallible guides, but one cannot fail to be impressed by some of those, the figures of which are so loud-voiced. Turning to the Commissioners' Report for 1893 we find the Chelsea Company is capitalized in $300,000, that its total sales for the year amounted roughly to 30 millions cubic feet, that the average price per 1,000 received was $1.84, that the average consumption per year per consumer was 18,346 cubic feet, and that the average consumption per meter per year was 3,736 cubic feet. The

"odious comparison," for instance, will be the case of the Lynn Company, which is capitalized in $375,000—both Companies have a bonded indebtedness which is practically equal—the output for the year was 65 millions cubic feet, the average price received per 1,000 cubic feet was $1.46, the average consumption per consumer was 25,734 cubic feet and the average per meter was 4,728 cubic feet. Meanwhile on the business reported the Chelsea Company paid a dividend of 6 per cent., whereas the Lynn Company paid 8 per cent. Of course we are aware that Lynn is a much better district for the gas trade than is Chelsea, but still this fact only brings out more culpably the folly in the past of the financial management in the latter place, for Lynn, with over twice the output at Chelsea, is satisfied to work under a capital load only one quarter greater than that of Chelsea. Those who care to carry out the figures given to their fullest meaning will appreciate the fact that if Chelsea were "financiered" as was Lynn, the Chelsea Company would not have been "up before" the Commission twice in three years.

However, what we are most concerned in is the manner in which the Commission managed the second edition of their Chelsea experience. To dispose of the complaint respecting the quality of the gas was simple enough, in that a recourse to the official tables of the State Gas Inspector was all-sufficient to show that the fault was not in the gas *per se*, since it had been tried many times during the year for candle power and had never been found wanting; and but once in the year had it failed to satisfactorily respond to the tests for purity, the standard for which is not remarkably favorable to the gas maker of Massachusetts. Certain remedies in the distributing practice were applied which cured the seeming poor gas. Then came the question of cutting the rates, and we submit the Commission has not shirked making a statement of the real trouble at Chelsea, even though that statement is neatly capsuled or enveloped in quite a cleverly compiled series of sentences. Yet no one can deny that the arraignment contained in these sentences is bald enough. We repeat them: "This is largely attributable to the imprudent policy pursued by the Company in former years in relation to the issuance of stock. * * * The over capitalization resulting from this policy should not be permitted to operate as a medium of burdensome charges. This may be obviated in a large degree by a price which contemplates a *low* rate of dividends. The reduction is based on these considerations." Meanwhile it is to be borne in mind that the original holder (or the heirs of the latter) of Chelsea shares, at the reduced rate of dividend, is getting a big return for his investment, although the investor who came in after the melon was cut does not occupy a similar happy position. Putting one thing with another, it looks that the Commission has very happily settled the Chelsea case; and if the *proprietors* of many another Company in the country would only do voluntarily that which the proprietors of the Chelsea Company must now do, the engineers in their service would have a heavy burden lifted from them. Engineers are quite human, and so cannot achieve the impossible—in other words, they cannot at the same time earn high dividends on excessive capital and keep the consumer from growling at the price that he is called upon to pay for the gas that he uses.

RETIREMENT OF MR. GEORGE S. HOOKEY.—Whatever the impelling cause for his action was, we most heartily regret to have to say that Mr. George S. Hookey has retired from the service of The Gas Light Company, of Augusta, Ga. As Superintendent he has guided its fortunes for so long a period that he had been considered a very part and parcel of it, and a more faithful steward never rendered an accounting. It is true that he is over three score and ten, but not to the eye nor to the belief of those who look upon him for the first time. Indeed, he is as capable to manage the works' end of the corporation as he ever was, and right sorry are we to learn that he is out of the active ranks.

NOTES.—At a meeting of the Directors of the Consolidated Gas Company, of Baltimore, it was resolved to accept the resignation of Vice-President Carroll, and Mr. James A. Garey was appointed to succeed him. Mr. Carroll resigned because of his appointment to represent this country as Consul at Dresden. The Company also declared a dividend of 2½ per cent. on the capital stock, which will give the shareholders a 5 per cent. return for the twelvemonth.——The water gas plant erected for the Consumers Gas Company, of Wilkes-Barre, Pa., by the Western Gas Construction Company, has been in active operation for two weeks, and Superintendent Flannigan, in a letter to the Construction Company, goes on record to this effect: "We take pleasure in adding that the results obtained are largely in excess of your guarantee."——At last a movement to secure a fairly reasonable price for gas tar from the "Tar Syndicate" is under way, the prime mover in the matter being Mr. E. H. Jenkins, Superintendent of The Gas Light Company, of Columbus, Ga., and President of the Western Gas Association. We will keep our readers posted in respect to the progress of the movement, which at present is in the formative stage.——The authorities of Meridian, Miss., are considering the advisability of purchasing the plant of the local Edison Electric Light Company, to operate the same on municipal account. The Company is to all intent bankrupt.

A Gas Man's Notes at the World's Fair.

By F. B. W.

After a careful inspection of the electrical display in the Electricity Building, and on the grounds of the Fair as well, all gas men will probably agree that there was a greater straining after catchy and flashing novelties of illumination and kaleidoscopic advertising than after a steady and uniformly good quality of practical and much needed internal illumination of the buildings. That this last was scandalously inefficient and expensive is sufficiently shown in the complaint of the various State Boards of Commissioners, mentioned editorially in the AMERICAN GAS LIGHT JOURNAL, of November 6.

The quality, quantity and arrangement of many of the exhibits in the Electricity Building certainly left much to be desired. The thought no doubt occurred to many gas men that a little economy of space and compacting of many loose exhibits there, would have given room for a most respectable show of the allied gas industries, instead of their being compelled to isolated loneliness in various other exhibition buildings. A few well arranged rooms, lighted with Welsbach and Lungren gas lamps, would have put to shame many of the boasted classes of incandescent gewgaws shown there.

In the Palace of Mechanic Arts much particularly profitable for the gas man's inspection was noticeable. The enormous steam boiler plant filled all with awe, while the oil fuel process used excited interest and admiration. The "Climax" boiler stirred one's curiosity to a high pitch. Think of a vertical boiler 15½ feet in diameter, 37 feet high, containing 1,000 3-inch tubes, each 12 feet long, or 2½ miles! A heating surface of 10,000 square feet, and a guaranteed evaporating capacity of 30,000 pounds, or 15 tons of water per hour! The steam is superheated in the upper coils of the boiler. The factor of safety is very high in boilers of this make, because of the small diameter of the inner shell exposed to bursting pressure. The proportion of grate to heating surface is 1 to 50.

Two distinct practices of dynamo driving were exemplified here. One, by belts run at high speed by engines of horizontal type, of 1, 2, 3, even 4 expansions, familiar to all. The other, direct connection to dynamo axes, by vertical compound engines, of 2 or 3 expansions, thereby avoiding belts, using less oil and economizing floor space. Three types of the latter system were shown here. The Westinghouse 1,000 horse power double-acting compounds, 200 revolutions, the General Electric Company's triple expansion, run at 100 revolutions with 160 pounds steam, and the German Schichau triple expansion, run at 180 revolutions, with 180 pounds steam, and developing 2,500 horse power. This engine only weighed 143,000 pounds. Its beauty of finish and performance made a striking contrast with the heavy General Electric Company's engine, which weighed 320,000 pounds.

In the Electricity Building the English showed a triple expansion engine, closely connected with a very heavy dynamo, both of which attracted much attention for plainness of design and compactness. The use of vertical close connected engines in America dates practically only two years back.

The English Galloway compound engine with rope driving gear also drew every passer's attention. Its great gain in floor space, rigid plainness of design and decreased expense for pulleys and belts—one-half the cost for an American tandem engine of same horse power—gave food for reflection.

The gas engine exhibits of Otto and of the Crossleys were better than we had been led to expect. A *triple* English gas engine, with electrical ignition attachment, was a novelty. It needed but a part of a revolution of the flywheel to be immediately started in full operation.

The gas coffee boilers in the Polish restaurant and Guatemala Building were enormous in their way, and models of convenience. Many of the gas ranges in the "Midway" were of great size and by well known makers.

A model Pintsch gas plant in the Transportation Building recalled the pregnant words of our President, Mr. Boardman, of the American Gas Light Association, on the compression of ordinary gas and its use for power, etc. Most gas men, while in Chicago, doubtless noticed the gas motor street railway cars of the North Chicago Company gliding smoothly along, without the ugly trolley. What an outlet for increased consumption of gas in our cities, without the trolley nuisance!

High vs. Low Temperature in the Cracking Up of Oils.

By Mr. R. S. Moss, in the *Journal of Gas Lighting.*

It would perhaps be advantageous to direct attention to the principles underlying the different methods now in vogue for cracking up oils, to obtain a rich gas, and thus enable one to form an independent opinion. In dealing with the various oils, we have first to consider the predominating series of hydrocarbons which exist in the particular oil we intend to use; also whether the heavier or lighter hydrocarbons predominate. The lighter the series of hydrocarbons, the lower the specific gravity of the oil. Such an oil would be dangerous to store, in comparison to another, in which the heavier hydrocarbons predominate, and the series to which these hydrocarbons belong will make some difference as to the mode of treating, so as to obtain the best results.

It is found that different oils are, for the most part, made up of a number of complex hydrocarbons. For instance, the crude paraffine oils obtained from shale by destructive distillation are made up of members of the olefine series ($C_n H_{2n}$), with varying quantities of true paraffines ($C_n H_{2n+2}$), some acetylene (C_2H_2), with traces of benzole (C_6H_6). Russian naphthas are made up of the same series of hydrocarbons in varying proportions; whilst the Canadian and American petroleums contain most bodies of the true paraffine series, with varying quantities of olefines and traces of benzole ($C_n H_{2n-6}$). Consequently we find, as might naturally be expected, that natural gas in the neighborhood of these petroleum springs contains a large quantity of the lighter and more volatile members of the paraffine series ($C H_4 + C_2H_6$) in company with hydrogen and varying quantities of carbonic acid. Coal oil is a very complex mixture, containing members of the olefines, paraffine, acetylene, benzine and other higher series of hydrocarbons. Thus we find the composition of these different oils is various and complex, and how best to distil or "crack" them, so as to obtain the greatest yield of permanent gases rich in carbon is the object in view.

The high temperature process is peculiarly a dehydrogenizing one at the expense of illuminating power. All the same, a high temperature is absolutely necessary to distil or crack up hydrocarbons containing a large quantity of inert or infusible matter of a mineral nature. Bituminous shale contains a large amount of silicate of aluminia, which absorbs a considerable quantity of heat, and holds the hydrocarbons down until a very high temperature has been attained—in fact, the heat retained by the silicate, at the end of distillation is so great that it pays to obtain the small quantity of residual carbon in the form of water gas by injecting superheated steam. Advantage was formerly taken of this fact in obtaining benzole from gum benzoin, which when distilled alone yields benzoate, but when mixed with sand yields benzole, due to the higher temparature. We find the process of ultimate decomposition most nearly realized in the sun's atmosphere, which is made up of the different elementary bodies resolved at this high temperature in accordance with their atomic weights. At a lower temperature—viz., that of the voltaic discharge—the hydrogen would unite with the carbon to form acetylene, the oxygen with hydrogen, to form water. From these two compounds we can obtain most organic bodies: Ethylene (C_2H_4), by hydrogenating acetylene, thus $C_2H_2 + H_2 = C_2H_4$; benzole, by keeping acetylene just below a red heat for a long time, $3C_2H_2 = C_6H_6$; naphthaline, by passing benzole or one of its homologues through a tube heated to redness; alcohol, by hydrating ethylene—thus: $C_2H_4 + H_2O = C_2H_5HO$; and so on. Hence we find present in coal gas, when a very high temperature has been employed, acetylene, hydrogen, benzole, naphthaline, etc.

If we slowly carbonize coal at a low temperature the oxygen present will combine with the hydrogen to form water; whilst if we distil rapidly at a high temperature, the water formed, and indeed some of the oxygen not yet combined with the hydrogen, will combine with the carbon and pass off as carbon monoxide and dioxide. Thus we have a selective property, which varies with changes in temperature. I have examined gases from one retort house which varied in the course of distillation of the charge of coal from 5 to 10 per cent. in the amount of carbonic oxide present—depending upon the temperature, weight of coal, etc. The higher the carbonic oxide, the lower the watery vapor, and *vice versa.*

Working on the small scale of high temperatures, I have produced from coal a gas containing 20 per cent. of carbonic oxide. We might term the nature of the destructive distillation of coal in our retorts a cumulative one, in which we resolve the complex substance coal into carbon. Our object is, of course, to obtain illuminating gas; and this we do, but only to a small extent compared with the amount of carbon that remains behind. Take woody fiber, for instance, which consists of cellulose, whose minimum formula is represented by $C_6H_{10}O_5$, we can easily understand that subjected to different temperatures in the retort, also depending upon the mass in comparison with the heated surface, we can obtain various compounds. We notice the hydrogen and oxygen exist in the proportions to form water; and thus we might imagine that cellulose was a hydrate of carbon, and that it was possible to break the water away, and leave all the carbon—thus: $C_6H_{10}O_5 = C_6 + 5H_2O$.

Then, again, take the following table:

Cellulose Alcoholoids.	Extreme Accumulation.
$C_6H_{10}O_5$	$nC_6H_8O_4$
$nC_6H_8O_4$	$n^2C_6H_6O_3$
$n^2C_6H_6O_3$	$n^3C_6H_4O_2$
$n^3C_6H_4O_2$	$n^4C_6H_2O$
$n^4C_6H_2O$	n^5C_6

The high temperature retort process required in order to partially produce the above reaction, which gives us carbon as the ultimate result, whilst the gentler processes found in Nature give us coal, is modified according to the method of decomposition employed. In our supposed case the numerical values of the cumulative formulæ are found to increase nearly by powers of "*n*." Hence one can understand that, as the temperature increases, the remaining bodies are split up into lower bodies, rich in carbon and free hydrogen; and, further, that they are liable to vary in the kind of decomposition at various temperatures, etc. For this reason we find the number of bye products and subsidiary reactions increase more slowly towards the end of distillation. Similar conditions hold good for all bodies susceptible to cumulative resolution; and hence we find homologous series present in coal tar.

It is easy to understand, from what has been said, that it is impossible to convert the whole of the denser oils and solid hydrocarbons into permanent gas without any residual carbon—containing, as they do, such an excess of carbon in proportion to the hydrogen present; and certainly the next best thing to do is to subject the hydrocarbons or oils to the conditions under which the hydrogen will retain the greatest amount of carbon; resulting in the production of a permanent gas insoluble in water—one which, under moderate changes in temperature and pressure, is not liable to be deposited in the mains and services.

We have for this purpose a well-known series of compounds, which we will take as an illustration of our meaning. The paraffine series or group—which begins with marsh gas or methane, and is represented by the general formulæ $C_n H_{2n+2}$; the olefines, $C_n H_{2n}$; and acetylenes, $C_n H_{2n-2}$. The series containing the greatest quantity of carbon give the highest illuminating or sperm value, when complete combustion takes place, and hence are the most valuable for enriching purposes. Looking over our three groups, we find the compounds represented by the formulæ $C_n H_{2n-2}$, the richest in carbon; the next, $C_n H_{2n}$ t he least, $C_n H_{2n+2}$. Between these three, we have a gradual increase of hydrogen. The first group are difficult to produce, as they require high temperatures, which set up, in attaining to it, subsidiary reactions, resulting (as before stated) in the formation of a large number of bye-products, which are soluble in water, are liquid or solid at ordinary temperatures, or are low in illuminating or sperm value. These conditions agree with our methods of distilling coal; and hence we find acetylene, three molecules of which combine, as the temperature increases, to form benzole, and this as the temperature further increases forms naphthaline, etc. The third series or group of bodies have a good illuminating value among the higher series, which unfortunately are liquid at ordinary temperatures, as benzole or benzine, toluene and xylene. The first of the series of group, marsh gas, CH_4, might be termed non-luminous; the next, ethane, C_2H_6, slightly luminous; and so on, until we reach the bodies having a high illuminating value, such as butane, pentane, hexane, etc. The lower or gaseous bodies of the second group have a high illuminating value, and are easy to produce under conditions of temperature recognized by the patentee of the Peebles process. They are nearly insoluble, both in oil and water, and hence offer the greatest measure of success.

We can easily understand that, as the oil passes through the retort, the lighter hydrocarbons are at once cracked up into permanent gases. The heavier hydrocarbons are simply vaporized; and, carried forward by the stream of permanent gases, they would in the ordinary course become condensed in the form of tar oils when subjected to the ordinary reduction in temperature. Hence they would be lost; but in the Peebles low temperature process they come in contact with the oil flowing into the retort, and are at once condensed and carried back. Herein lies the great point of difference which is proving so successful.

We here avoid, as far as possible, the production of gases of the paraffine series. They are, for the most part, soluble in oil; and they thus become liable to over-cracking on their being constantly returned to the retort, and thereby produce gases having a low illuminating value. These gases are peculiar to the high temperature industry. The olefines,

from C_2H_4 to C_4H_8, are permanent gases of high illuminating value; and to my mind they are the series of gases to aim at producing in cracking up oils. These valuable hydrocarbons are produced in largest volume by subjecting the oil to a low temperature. In the Peebles process, the cracking up of the oils is carried only so far as to produce those hydrocarbon gases in which the greatest quantity of carbon is united with hydrogen. This is compatible, of course, with the production of a gas or gases of high sperm value, insoluble in oil and water, not liquefied under any ordinary changes in temperature and pressure. As it is impossible, from the nature of the process, for any carbon in the form of soot to be carried away, and further as the process does not produce anything in the nature of tar, by taking the weight of gas produced, together with the coke left in the retort, we obtain the quantity of oil employed, *plus* a slight loss. We therefore need not be surprised to learn that this process leaves more coke than has been before obtained.

There can be no doubt that fractional distillation is the correct method. One has only to remember that we are dealing with a substance composed of a mixture, for the most part, of fatty hydrides, having different boiling points, and it is easy to understand that the temperature employed, must vary to suit these different hydrocarbons, so that the lighter ones are not over-cracked, and reduced to hydrogen, methane, etc.; also that the heavier ones are sufficiently cracked up by easy stages. In arriving at the temperature best suited to any particular oil, we must consider its density. From this it will be found a very easy matter to arrive at the required temperature for cracking up into a rich and permanent gas. Analysis of the gas made by the Peebles process shows it to be composed of hydrocarbons belonging to the olefiant series ($C_n H_{2n}$); therefore it is for us to produce the largest volume of those higher series of gases, which are permanent under ordinary conditions of temperature and pressure. We must look upon our oils as hydrocarbons containing so much hydrogen combined with excess of carbon; and how best to crack them so as to produce a permanent gas insoluble in oil and water, is the problem before us. That residual carbon must remain, is certain, whenever the heavier grade oils are employed. The weight of residual carbon will, of course, vary with the density of the oil employed. The greater the density of the oil the more residual carbon will there be; the lighter the oil the less residual carbon. Tar, and carbon in the form of soot, are to be avoided as so much waste, besides being unscientific. As to the stratification of gases, is it not rather due to the presence of those light oils which are carried along by the permanent gases, than to the actual difficulty of mixing those gases having some well known and determined composition? All the same, supposing the gases from the coal and oil are brought together at the inlet to the purifiers, this difficulty vanishes at once, because, when thoroughly intermixed, layering or stratification will not take place. That light oil vapor can be carried along by the permanent gases was fully proved to me during my journey through the States, where in a great many places I noticed the burners had an oily appearance. The main siphons contained a large quantity of oily condensation at a considerable distance from the works. In some cases the burners had the appearance of having been dipped in oil. This proved, of course, two things—viz., that the burners in the first place were not suitable, and secondly, that the oil had been vaporized and not cracked up into a permanent gas, or had been over-cracked, as I found was the case wherever the process was conducted at a high temperature, producing large quantities of benzole. This state of affairs was specially observable wherever oil gas was exclusively employed.

It is worthy of notice, in passing, that aromatic hydrides ($C_n H_{2n-6}$) are not produced in any of the low temperature methods, only in very minute quantities; and to this extent the products from the high temperature industry might be recognized by the presence of these aromatic hydrides. We find American and Russian petroleums contain the greatest amount of liquid products having a low boiling point. These, no doubt, have been produced by the long continued action of a very gentle heat. Further, we get traces only of those compounds which are produced at a high temperature—viz., aromatic hydrides—and naptha line, which is not found in petroleum. Petroleum contains both hydrogen and the fatty hydride ($C_n H_{2n+2}$) from CH_4 to $C_5 H_{12}$, in solution. These are gases or vapors at ordinary temperatures, and hence they have to be removed. If allowed to escape, they would mix with the air, and furnish a highly explosive mixture. Petroleums are found to vary very much in composition; but for most practical purposes it is sufficient to ascertain the specific gravity as a guide to working them successfully.

With respect to finding the illuminating power of rich gases (which means gases rich in carbon), they must be diluted with non-luminous gases, or a poorer coal gas, or, if not too rich, consumed at a less rate than 5 cubic feet per hour in a flat-flame burner, or an Argand burner with a taller chimney, and calculated to the 5 cubic feet rate. In all cases a clear, steady and non-smoky flame must first be obtained—not very small, or the cooling effect of the burner will give results much too low. Rich gases require more oxygen for their complete combustion; and further, the light-giving value of a rich gas is increased up to a certain point by the addition of hydrogen, methane, carbonic oxide or other non-luminous gas. The greatest illuminating power is obtained when all the carbon particles are heated to whiteness first and consumed afterwards. It is the special character of hydrogen, methane, carbonic oxide, etc., to produce, by their rapid combustion, a high temperature. Therefore, when a gas rich in carbon is mixed with these non-illuminants, they produce by their rapid combustion a temperature sufficiently high to render the carbon particles incandescent. Thus we obtain a higher illuminating power. All the same, I scarcely consider it sound reasoning when a rich gas tested alone has only (say) 60 candle power, but when it is mixed with a poorer gas, such as hydrogen, has 90 candle power, to say that 60 candles is its true photometric value. It is rather, that, in the first case, we do not obtain the highest efficiency of the hydrocarbons present. Therefore I think it would be more accurate to say that this difference is so much candle power loss, due to imperfect combustion. It would be much better to speak of the photometric value of a rich gas as that which was obtained when all its carbon particles did duty in producing its quota of light. Methane is composed of one atom of carbon combined with four atoms of hydrogen. The heat produced by the combustion of this hydrogen is not sufficient to render the carbon incandescent under normal conditions. Hence we do not obtain light. Again, the great quantity of water vapor produced also prevents the temperature from rising sufficiently high. Take olefiant gas ($C_n H_{2n}$). Its complete combustion is shown as follows:

$$C_2H_4 + 3O_2 = 2CO_2 + 2H_2O.$$

In this case we have twice the amount of carbon. Hence we get one atom heated to whiteness (or rather dull red), and light produced; and so on up the scale, until from a gas that furnishes light we pass on to those heavier gases that give off smoke when consumed in ordinary burners. This is due to the large amount of carbon present. The hydrogen first combines with the oxygen of the air, and leaves the carbon, which, being set free in large quantity, is carried away in the form of soot, owing to the heat produced by the combustion of the hydrogen, and some carbon being insufficient to heat the carbon particles to a state of incandescence. Clearly, then, we must raise the temperature of the flame. But how? Simply by the addition of hydrogen and other poor gases; so that the heat produced by the combustion of these gases is sufficient to raise the carbon particles to a state of incandescence. When this is attained, we are obtaining the greatest possible amount of light from the gas itself. There must consequently be a limit where the further addition or reduction of these poorer gases must be detrimental to the highest results being obtained. The reason for adding oxygen to the oil gas made by the hydro-oxy process is simply to increase the rapidity of combustion, which gives us a higher temperature, and in this way renders the carbon incandescent, in the same way that the air from a pair of bellows makes a fire glow more brightly at the expense of a greater consumption of fuel.

Summing up the high and low temperature methods, and putting the results side by side, we find the high temperature method of cracking up oils results in the production of carbon in the form of soot, which is practically useless; some tar oils containing large quantities of benzol; and a gas the illuminating value of which depends upon easily condensable hydrocarbons, and therefore rapidly deteriorates when subjected to low temperature or pressure. Thus, starting with soot, we get: C (solid and useless), CH_4 and C_2H_6 (gaseous), H and C_2H_2 (gaseous), C_6H_6 (liquid), C_2H_4 (gas), and $C_{10}H_8$ (solid), etc. The low temperature industry produces a different set of reactions, and the series are more regular; the illuminating value of the gas depending not upon easily condensable hydrocarbons, but upon a well-known series of rich and permanent gases belonging to the olefiant group of bodies ($C_n H_{2n}$), such as ethylene (C_2H_4), propylene (C_3H_6), butylene (C_4H_8), etc., and the only residual product being a valuable coke, hard and compact, usually very free from ash and sulphur—depending, of course, upon the oil employed. Such a gas as the above would not deteriorate when subjected to the lowest temperature or pressure found in ordinary working. This low-temperature process gives a series of reactions which are far more favorable to success than we can ever hope to obtain from the high-temperature method.

I think I have clearly proved the greater value of the low as compared with the high-temperature method of cracking up oils, to obtain a rich and permanent gas.

Salomon's Process of Obtaining Hydrogen and Carbonic Acid Gas.

Letters Patent were issued on October 24th to Mr. Fritz Salomon, of Essen, Germany (the inventor subsequently assigned the same to the celebrated Krupp gun making firm), for a process having for its object the manufacture of a water gas substantially free from carbonic oxide, the ultimate product to be technically pure hydrogen and carbonic acid gas. In the specification the inventor says:

When water vapor is passed over incandescent carbonaceous material, gas is obtained composed of a mixture of hydrogen, carbonic oxide and carbonic acid. By operating at a comparatively low temperature less carbonic oxide and more carbonic acid can be obtained, but the maintenance of a low temperature has practical difficulties and less gas is produced. At temperatures at which a plentiful supply of gas is evolved a considerable quantity of carbonic oxide is always produced in view of the two following reactions occurring simultaneously:

$$C + 2H_2O = CO_2 + H_4.$$
$$C + H_2O = CO + H_2.$$

I have found that the reaction of the water vapor takes place more energetically and occurs at low temperatures if the carbonaceous material (coal, coke, peat, etc.) has been previously impregnated with a soluble hydrate or carbonate of the alkalies, or alkaline earths, or with combinations of the alkalies or the alkaline earths which by their decomposition will produce the above mentioned substances.

As suitable for the purposes of my invention may be enumerated the following substances: Sodium hydroxide (NAOH); sodium oxide (Na_2O); potassium hydroxide (KHO); calcium hydroxide (CaH_2O_2); barium hydroxide (BaH_2O_2); potassium carbonate (K_2CO_3), and sodium carbonate (Na_2O_3).

After the carbonaceous material has been impregnated—say with a solution of carbonate of potassium—and dried, the mass is placed into a retort and subjected while at a red heat to ordinary or superheated steam; the production of water gas now takes place at comparatively low temperature and the gas consists almost entirely of carbonic acid and hydrogen. Carbonic acid is present only in minute quantities if the temperature of decomposition is properly restrained. Its quantity is further diminished by the exclusion of atmospheric air, and the use of retorts of clay or other similar refractory material in place of iron; the result being that a gas technically pure from carbonic oxide is obtained.

The gas obtained according to my process may be used for heating purposes—also for illuminating purposes in magnesia lamps—it being adapted especially for these purposes in virtue of the absence of the poisonous monoxide.

To separate the gas into its constituent gases, when the latter are to be used separately, it is passed over lime in the usual apparatus for that purpose, whereby the carbonic acid is absorbed and the hydrogen liberated. The carbonic acid is then regained from the carbonate of lime in any usual manner, as for instance, by the use of one of the stronger acids (sulphuric acid). Of course any other usual process of separation may be followed.

The great tendency of the process to follow the formula

$$C + 2H_2O = CO_2 + H_4$$
(carbon and water = carbonic acid + hydrogen)

may be explained by the low temperature of reaction caused by the low heat conductivity of the respective admixtures—but most probably is caused by an intermediate formation of hydrates of the substances used, whereby the vapor of water is brought into intimate contact with the carbon, so as to cause a reaction according to the above formula. The supposition is that a continuous decomposition and regeneration of hydrate take place, whereby a substantially constant low temperature is maintained. These decompositions and regenerations may be explained by the following formulas:

I. Decomposition of hydrate—

$$K_2CO_3 2H_2O + C = K_2CO_3 + CO_2 + H_4$$
(potassium carbonate with two equivalents of water + carbon = anhydrous potassium carbonate + carbonic acid + hydrogen.)

II. Regeneration of hydrated potassium carbonate—

$$K_2CO_3 + 2H_2O = K_2CO_3 2H_2O$$
(anhydrous potassium carbonate + water = hydrated potassium carbonate.)

As in the production of alcoholic ethers, under intermediate formation of ether sulphate, a small quantity of sulphuric acid is sufficient to transform a large quantity of alcohol into ether, so, in the present case, it may be assumed that a small quantity of the salts mentioned is sufficient to insure the desired course of the process by the intermediate formation of hydrate which effects the necessary condensation of steam upon the carbon.

The inventor's claims for originality in the process are:

1. The herein described process for manufacturing a water gas practically free from carbonic oxide, consisting in impregnating the carbonaceous material with an alkaline hydrate, or its equivalent, as set forth, then heating the material thus prepared, and passing water vapor into contact with the same.

2. The herein described process for manufacturing hydrogen gas and carbonic acid gas, consisting in impregnating carbonaceous material with an alkaline hydrate, or its equivalent as set forth, then heating the material thus prepared and passing water vapor into contact with the same, and finally separating the gases.

Petroleum Mining at Mendoza.

The *American Engineer* notes that one of the many mineral products found in the Argentine Republic during the last three years has been crude petroleum, which was first believed to be existing in the province of Jujuy, but after some $100,000 had been expended without favorable results to the mining company, it was resolved to abandon that province and try in the adjoining one, Mendoza, in which State, at a place called Cacheuta, in the department of Lujan, where recently 12 perforations were made for petroleum and gave the following results:

Well No.	1,	depth 110	meters.	Abandoned.
" "	2,	" 103	"	Gave asphaltum.
" "	3,	" 67	"	Good petroleum.
" "	4,	" 90	"	Worked.
" "	5,	" 103	"	"
" "	6,	" 200	"	Spoiled by carelessness.
" "	7,	" 70	"	No result.
" "	8,	" 210	"	Hot water, sulphurous; worked.
" "	9,	" 210	"	Worked.
" "	10,	" 220	"	Abandoned for want of material.
" "	11,	" 104	"	Signs of petroleum.
" "	12,	" 30	"	" "

The wells Nos. 4, 5 and 9 are the only ones giving petroleum, and these are worked by means of a crank-wheel from the principal engine shed, the oil running through pipes to two large tanks in the hollow, which have a capacity of 200 c.m. From these tanks the crude matter is conducted through 5 inch pipes to the chief depot, located at a small village called San Vicente, 1½ miles from the city of Mendoza, which is the terminus of two railways the Ferro Carril Gran Oeste Argentino and Ferro Carril Trasandino. Both of these companies use a great deal of the native mineral for their locomotives in place of coal, which costs at least $12 per ton. A large gas company established at Mendoza is one among other concerns utilizing the crude petroleum, which is similar to black tar.

The cost of laying the piping from well to depot (where there is a tank which holds 3,000 c.m.), at San Vicente, a distance of 42 kilometers (24 miles), was about $124,000; for three tanks, about $30,000; for working expenses, about $420,000; total, $574,000 (national dollars.) The perforation of the wells must be added, which cost, more or less, $105 (paper money) per meter (39⅜ in.).

To meet the above expenditure and maintain workshops and erect houses for the workmen, about 50 in all, a company was formed with a capital of $1,000,000 (Argentine dollars), at Buenos Ayres.

As it is so styled, La Compano Mendocina de Petroleo has an extent of about 4 square leagues (12 miles) of ground, and the works are at the foot of a spur of the Cordilleras de los Andes.

The price at which the petroleum is sold varies according to the money market, but the average rate is $12 in gold the cubic meter (cubic yard), or 55 cents per gallon. Since the first borings commenced at Cachueta (Mendoza), over 2,000 tons of fluid have been produced, which seemingly made a difference in the figures of imported petroleum for the year 1891, when only 2,300,000 gallons of that oil was received in the Argentine Republic against 3,100,000 in 1888.

To illustrate the advantage of using petroleum as an engine fuel instead of coal, I will give an extract from one of my engine mileage and storage sheets (Argentine Great Western Railway Company) of two locomotives for one month. Engine No. 50 (running on coal and wood) traversed 683 miles, consumed 21,709 lbs. of coal, 1,550 c. ft. wood; oil and tallow, 117 lbs.; hauled 10,383 vehicles. Engine No. 51 (with petroleum fuel and little coal), ran 1,312 miles, consumed 8,593 lbs. of coal and 35,155 lbs. of petroleum, hauling 24,484 vehicles, consuming 174 lbs. of oil and tallow. In the following table is a resume of the averages upon each of the before mentioned engines:

	Average of Coal per Mile. Lbs.	Average of Oil and Tallow per 100 Miles. Lbs.	Vehicles Hauled per Mile.
Engine No. 50	31.78	17.13	15.20
Engine No. 51	6.82 / 26.79 pet.	13.26	18.66

The above figures show very clearly the saving there is in having petroleum as fuel, and it will be worth the while of North American engineers and locomotive superintendents to turn their attention a little more to liquid fuel, which has been used with success on a few railroad lines in South America.

Effects of Strain on Machinery.

A writer in *American Machinist* in contending that one of the things which most machinists have to learn is that they are not working with materials that are really "unyielding," as iron and steel are commonly considered to be, remarks that they are actually dealing with materials that yield to every strain imposed upon them. It is far too common when shaping parts of machinery, or when erecting machines, to impose strains of various kinds upon them, and assume that they do not change form on account of those strains. Instead of this it should be more fully realized that in every case there is a change of form, depending upon the character and amount of strain; and whether or not this change of form will be prejudicial should be considered.

A cast beam, specially designed for extreme rigidity, will yield readily to a small transverse strain, as is perhaps best shown by bench measuring machines, in which, though the bed of the machine may be what we call extremely rigid, yet a small lifting force applied to one end of it produces a very perceptible effect in the way of bringing the contact points together, an effect which is readily perceived by the present refined methods of measuring.

One of the most vivid proofs of the extreme elasticity of steel is afforded by a very interesting experiment made by Sellers Bancroft at the works of William Sellers & Co. Three cylindrical steel posts, 1½ inches diameter and 10 inches long, were placed in a vertical position upon a steel disc, the three posts arranged in the form of a triangle. On top of these was placed another steel disc and arrangements were made by which a pound weight could be very carefully placed upon or removed from the upper disc. An electrical contact was arranged in such a manner that any diminution of length of the columns would cause a bell to ring. It was found that this pound weight was sufficient to make and break the contact, the bell continuing to ring so long as the weight was in place and stopping whenever it was removed.

By experiments made upon specimens of the same bar of steel, and by calculation, it was determined that the steel bars were compressed $\frac{1}{14000000}$ of an inch, which, it is true, is a very small amount, but then one pound is a very small load for steel posts capable of supporting over 200,000 pounds without permanent deformation, *i. e.*, within the elastic limit of the material, and the experiment shows that even the lightest strain cannot be imposed upon the materials we handle without a corresponding yielding; which yielding may or may not be disregarded according to circumstances.

To this fact that metals always yield under strain is undoubtedly due much of the "wearing to a bearing" that is often considered necessary in new machinery. Machine spindles ground and lapped accurately to a bearing while unloaded and subjected to no strain may not be to a bearing when loaded and in operation, especially if subjected to transverse strain.

Engine crank shafts deflect by the load of the fly wheel and other strains put upon them. Surfaces scraped to a surface plate are no longer true when differently loaded, or when the weight of the machine itself is allowed to produce distortion.

New Gas Wells in the Pittsburgh District.

Am. Manufacturer says that the Swagler well No. 1, struck about a month ago on Jacob Swagler's farm, in Somerset township, Washington county, 12 miles east of Washington, Pa., is regarded as the largest gas well in the world. It belongs to one of those private lines laid by Pittsburgh manufacturers, and was drilled by the Monongahela Natural Gas Company, which was organized four years ago with a capital stock of $1,000,000. It is stated that the gas started in the fifth sand, at a depth of 2,700 feet, and its roar was heard 15 miles away. The drillers worked with cotton in their ears and communicated by sign. The Monongahela Company had 32 wells in that field, but all were plugged in order to use the product of this one great gusher. The Monongahela Company is composed of H. W. and David B. Oliver, of the Oliver Iron and Steel Company, and some of the stockholders of the Republic Iron Works. A short time since the Somerset township leases of the Monongahela Company, including but one well, the Swagler, was sold to the Philadelphia Company, and it is now sinking five other wells.

About two weeks ago the Philadelphia Company, of Pittsburgh, which virtually controls by lease and traffic arrangement the business of supplying natural gas fuel to private residences in Pittsburgh and Allegheny, "brought in" its 913th gas well. This well is located in the Monroeville field, 13 miles from Pittsburgh. This company has 11 first-class wells in reserve, 10 being located in South Buffalo township, Armstrong county, 28 miles north of Pittsburgh. The company's experts say natural gas will be found as long as oil, and its supply has been ample for 30 years, but it may have to be piped long distances. The original gas fields of Murraysville and Grapeville, in Westmoreland county, are running low, but substitutes have been found, the drillers having made a complete circuit of Pittsburgh within a radius of 30 miles during the last seven years.

Simultaneous with the success in Washington county, south of Pittsburgh, was the discovery of natural gas in a westerly direction in New Sewickley township, Beaver county. This is about 20 miles distant from Pittsburgh. At the usual depth no gas was found, and the well was drilled 500 feet deeper, when the gas forced its way to the surface with such a pressure—300 pounds—as to blow out the packing.

The Proposed Amalgamation of the Russian Petroleum Industry.

The negotiations for an amalgamation of all the Russian petroleum establishments, it is said, are still progressing at St. Petersburg, with what seems fair prospects of ultimate success. It would be considered sufficient if 80 per cent. of the petroleum works entered the amalgamation, and the projected union will arrange with the American petroleum works how the world's trade is to be divided between the Russian and the American petroleum producers. In 1892 there were going at Baku 104 petroleum works, with an aggregate production of 78,521,927 poods of petroleum (about 1,283,800 tons), of which total as much as 60,341,112 poods (about 986,500 tons) came from 17 large works, representing 76.8 per cent. of the total. It does not seem unlikely that at least these may agree upon output and price, and also arrive at some arrangements with the American petroleum syndicate. Against a coalition of this magnitude the small works, which were outside the arrangement, could carry no weight. The consumption per individual varies very considerably in the different countries, as will be seen from the following table:

Russia	5 kilogrammes.
Sweden and Norway	10 "
Great Britain	13.4 "
Denmark	13.8 "
Switzerland	14.8 "
Germany	16 "
Holland	26 "
Belgium	38.5 "
United States	75 "

(One kilogramme is equal to 2.2 lbs.)

The sale of Russian petroleum has increased from 50.2 million poods (about 820,000 tons) in 1888 to 78.5 million poods (about 1,283,000 tons) in 1892.

Coal in Western Sweden.

The first researches for coal in the province of Sconia date from the year 1737, at Vallakra, some six miles from the town of Helsingborg; in the year 1744 the experimental boring was resumed at Bosarp, not very far distant. Here the undertaking was continued under private initiative until 1796, when it was formed into a company, which began work at Hoganos the following year. For more than 20 years this company continued work, until it, in the year 1825, was transformed into the still existing Hoganos Coal Company. In addition to coal mining, the Company has also gone in for other industries, in order to make good the natural materials at its disposal, such as earthenware, firebricks, etc. The Company employs about 1,000 hands. In the year 1760 extensive coal measures were secured by a private firm at Vollakra, and after a lapse of about a century work was resumed there, two pits being sunk. In 1866 the Vollakra Coal Company was formed, with a capital of 1,500,000 kr. (about $412,500); it subsequently removed to Billesholm, where it is still working, and with good results. The Kropp Company was formed in 1871, and worked for a number of years a pit at Bjuf; a new pit has now, with great trouble, been brought into working order, and the manufacture of firebricks has also been adopted on a large scale. The Skromberga Coal and Clay Company is the youngest of the Sconian coal companies; it employs about 500 hands, and was formed in 1886. In addition to these there are several small mines, which are not of much importance.

Appendix to the Paper on Gas Engines in the American Market, Read by Mr. F. H. Shelton, before the American Gas Light Association.[1]

The following list of gas engines was compiled from personal knowledge, catalogues, correspondence, a large number of personal examinations of the various engines, and interviews with the makers, involving considerable time, expense and a conscientious effort to make the list complete. It is believed that no engines of prominence have been omitted. Any omission whatever of any make is entirely unintentional.[2] A circular letter was sent to every manufacturer that I could learn of, asking for a description of and information regarding each engine. All were afforded equal opportunity for a correct statement. Many responded and to those I herewith express my appreciative thanks for their courtesy. To those who did not, I would simply say, that if any inaccuracies have crept in regarding their engines, I will not take blame for having to post myself as best I might from unauthoritative sources. I would very much have liked to give a careful, detailed description of the design and action of each engine, but in the limits of this paper—at best a long one—it was quite impossible. I have, therefore, been obliged to content myself with aiming to give in each instance (where I had the information) a skeleton description and account of it, as follows:

1st. A cut of a typical engine.
2d. Type or cycle.
3d. Form (horizontal, vertical, etc.).
4th. Distinctive features.
5th. Style of valves.
6th. Method of ignition.
7th. Method of governing.
8th. When and by whom designed.
9th. When put on American market.
10th. Sizes made.
11th. Approximate number made.
12th. Where and by whom made.
13th. Gases available, and operating figures made or claimed.
14th. Reason for discontinuance.
15th. Memorandum of where detailed description may be found.

In order that what follows may be the more clear to those who have perhaps but little knowledge of gas engines, let me first briefly give a classification of them, and a description of the features peculiar to their operation—viz., valves, ignition and governing.

There are two *types*, viz.:

I. *Non compression Engines.*
II. *Compression Engines.*

Type I. is again divided into two classes:

A.—Atmospheric engines, in which the gas does not give power directly to the piston, but drives it up by the explosion, the power being gained by the action of the atmosphere destroying the vacuum so formed, upon the return stroke of the piston. (See Otto and Langen, below.) This class is now obsolete.

B.—Engines in which the "cycle of operation" (which is merely a gas engine term for the piston action) is as follows: During the time of one complete revolution of the flywheel the piston first draws in an explosive charge of mixed gas and air; at one-third or so of the stroke forward this is fired, driving the piston to the end of stroke and giving the power; on the return stroke the burnt products of combustion are driven out the exhaust, and this "cycle" is then repeated *ad libitum.* (See Sombart, etc.)

Type II. may be divided into classes, as follows:

A.—Engines in which the firing or power cylinder is also used for compressing the charge before explosion, in alternate revolutions of the flywheel. This action has been so widely made known by its extended use in the Otto engine, that it is generally known as the "Otto cycle." In the first out stroke the piston draws in the charge; on the return stroke it is compressed; in the next out-stroke it is fired; the second in-stroke drives out the burnt products, or exhausts. Thus two revolutions of the flywheel occur to every one impulse, hence the term "2 cycle." The majority of American engines now work on this principle.

Class B.—Engines that use an auxiliary and separate chamber for compression in order to become a "1-cycle" form, or to secure an impulse each revolution in the power cylinder. In these, some use a side cylinder, having its own piston for compression, as in the Clerk, Storkport, etc. Others use a chamber in which the power piston creates pressure, as in the Baldwin, Nash, etc. In any case while the power piston is acting, the auxiliary chamber is preparing the next compression charge, which at the right point is admitted to the power cylinder. The advocates of this class point to greater regularity of operation; the opponents, to greater friction and often to greater gas consumption.

Class C.—Otto, or two cycle engines, as in class A, but with a scavenger charge introduced by an auxiliary chamber. (See late Rollason horizontal forms.) This "scavengering charge" is a volume of pure air forced through the cylinder after explosion, to drive out all the products of combustion, so ensuring a clean, undiluted succeeding charge for each firing.

Class D.—Three-cycle engines, in which the first two revolutions are the same as the Otto cycle, plus a third revolution, in which a scavengering charge is drawn in and expelled before the cycle is repeated. Hence, an impulse is had only every third revolution. (See early Rollason).

The "Griffin" three cycle engine is "double acting." Hence, an impulse is given every one and a half revolutions.

There are four styles of valves generally used:

1st. The slide valve, of which that used in the earlier Otto is typical, being a flat casting working against the cylinder with a reciprocating movement, having cored passages that at the proper time afford communication between the various gas and igniting ports. This form is expensive to make, needing the finest workmanship; it needs constant lubrication, cleaning and adjustment, and is gradually being discarded.

2d. The poppet valve form is the one now generally adopted. These valves are round, cone shaped discs, on spindles that lift off their seats, and are variously known as "mushroom," "spring," "disc," "lifting" valves, etc. They require little or no lubrication, are easily made and ground to a seat, and are usually operated by cams, tappets, or a difference of pressure on either side.

3d. Circular "rotary plate," or disc valves, as in the Continental, Safety-Vapor, Evans and Forward engines. These are of cheap and simple construction, and have ports that during rotation connect with the proper channels. They need to be carefully designed and made to give satisfaction.

4th. "Piston valves," as in the Lawson and the Pittsburgh "measuring valve," etc. These are of round plunger form, with a reciprocating motion similar to a pump or steam engine "piston" valve.

Governing is effected usually:

First.—By omitting the admission of charges until the engine slows down to normal speed.

Some methods of further action are as follows:

(*a*) In the Otto and others the engine meanwhile works on a vacuum, with back pressure friction that tends to quickly restore normal speed.

(*b*) In the "Union" the exhaust is thrown open, so that on atmospheric pressure with the least friction, the engine will run longer without fresh gas, but, per contra, is slower to return to regular speed.

(*c*) In the Daimler the exhaust is kept closed, affording no gas ingress nor outlet for products of combustion until speed is reduced.

Second.—By reducing the quantity of the standard mixture of gas and air, thus giving an impulse every revolution, but a weaker one at times. (See Pittsburgh, Korting, etc.) This induces the greatest regularity of speed, but is a shade less in economy than method No. 1.

Third.—By admitting the full bulk charge, but weakened by air dilution. This is an easy method, but cannot give best theoretical efficiency, as there must be some definite proportion of air with whatever gas is being used, for greatest explosive power; varying this loses efficiency.

In some forms the charge is diluted by the products of combustion; in others the above methods are combined. Still other methods also appear that it is not necessary to here detail.

In ignition, three methods are followed:

1st. *Flame:* This was the early practice. Its chief merit, and not a constant one, is simplicity. Its objections are numerous. Its heat tends to destroy lubrication of adjacent moving parts; the expansion of such begets scoring and grinding. It consumes, in smaller sizes, a perceptible percentage of gas. It deposits carbon, or "soot" and dirties. It gives an odor sometimes; it blows out occasionally. As a rule it is now replaced by

2d. *Tube ignition, i. e.*, a short piece of small iron tube kept incandescent by a bunsen burner. This is the current, most used form. To ensure its best working, a timely device should be used. Its chief objection is, that the tubes granulate and rapidly burn out; special alloys are now used, however, in which a life of six months to a year is secured.

3d. *Electric spark:* This was early tried and largely abandoned, but

1. For the paper proper see Journal, Nov. 14, 1893, page 686.

2. As this paper goes to press and too late for investigation, I am told that there are a few new forms not herein covered; one by A. J. Signor, of Elkhart, Ind., made to 2-horse power, since June, 1893; one known as the "Baker," in Chicago; and one being brought out by Krouse & Weis (?) 124 East 14th street, New York.

lately has come into common use as the mechanical details are bettered. The small dynamo of the Parker and Baldwin forms is now generally replaced by a battery and spark coil. Various devices for giving either continuous or intermittent sparks are used, with "contact breakers," "electrodes," etc. Prominent advantages of electric ignition are those of cheap maintenance, and that the high temperature of the igniting spark ensures ignition where producer or other not easily ignited gases are used.

All gas engines, excepting the smallest non-compression forms (the Sombart, Crown, early Economic, etc.), use a water cooling jacket around the cylinder to absorb the heat of combustion. Otherwise the cylinder would get so hot that all lubrication would be destroyed and action cease.

Regarding efficiency of the various engines, I have quoted what figures I have run across, but distinctly do not certify to their correctness. On "gilt-edge" tests," with "exhibition" and "racing" machines, results have no doubt been obtained as low as 15 feet per horse power per hour. But in every day, average practice I think the generally accepted figures of 20 cubic feet still hold as the working efficiency of good gas engines. It should be borne in mind that the smaller sizes do not give this efficiency, but run nearer 25, 30 and 35 feet. All sorts of claims are made by the makers, as in everything else. A common one is, "We guarantee our gas engine to use from —— to —— per cent. less gas than any other make." With a dry humor, worthy of reproduction, one maker comments that if so, "then one would merely have to use a few gas engines of different makes, in order to have large quantities of gas to sell." I also find *several* concerns each of which is the *only* one using gasoline direct; one that is the *only* one that can use a circulating water jacket; others the *only* one firing every revolution, etc., etc. Of course such claims are foolish as many makes each do these things.

Every engine herein mentioned has been used with manufactured gas, hence comes in our province. Many are now used, also, with gasoline gas, or with liquid gasoline used direct in the cylinder; some are chiefly pushed on these lines. Many use natural gas, others producer gas. It is obvious that any such agent that is explosive can be used, provided the detail of valves is arranged for handling it. Most engines are now made so that very little alteration of detail provides for using whatever gas is desired.

Considerable confusion is had from the varying practices of some makers in rating engines at "indicated H. P.," and others in selling by "brake H. P." The "indicated" or "nominal" horse power is that that is shown inside the cylinder. As the friction of the engine, however, consumes part of it, the purchaser gets in effectual, "actual," or "brake H. P." only that that the belt transmits from the flywheel. The difference runs from 15 to 25 or 30 per cent. in sundry makes of engines, and is a point purchasers should look out for.

It would be obviously wrong for me to single out any of the engines described below as better than others. Intrinsically, I believe each form mentioned to be a good gas motor. Some, of course, are better—some very much better—than others. In commenting on any points as attractive or otherwise, I intend no indorsement or disparagement of the engine as a whole. The total balance in my mind may be quite the other way.

The engines are mentioned in general chronological order, in so far as I have been able to so list them.

Otto & Langen.—As far as I can learn, gas engines in the United States date commercially from the time of the Centennial Exposition in 1876. There was then on exhibition, attracting considerable attention, the Otto & Langen engine, of (1867) German make, and in the next year or two some few of these engines were put upon the American market. This engine was handled by the owners of, and was the forerunner of the Otto, but in action is totally dissimilar. There is no compression; the gas does not create power directly by acting against the piston. It is used as an agent for quickly driving up the piston and piston rod, that at that time are entirely disengaged from the shaft or other gear. This creates a vacuum in the cylinder, and it is the return of the piston by atmospheric pressure from without (aided by its own weight) that gives the power, during which time the piston rod, by a ratch or clutch gear, engages with and transmits its power to the shaft and flywheel. This is known as the "atmospheric" or "free" or "flying piston" type. In economy it was excellent, showing from 21 to 30 feet per brake H.P. in a 3 H.P. engine; few engines of its small size have since equaled it. The high piston velocity and great expansion (some ten volumes) contributed to this. But it was heavy, cumbersome and unsteady in action, and "it made a horrible noise." So much so that this was a chief reason for its falling out of the market and its successor

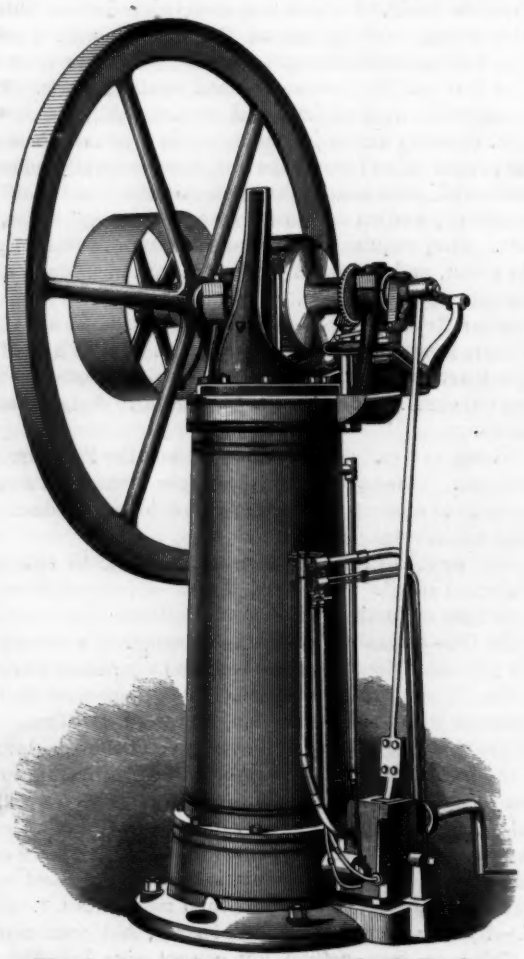


Fig. 1.—Otto & Langen Atmospheric Engine.

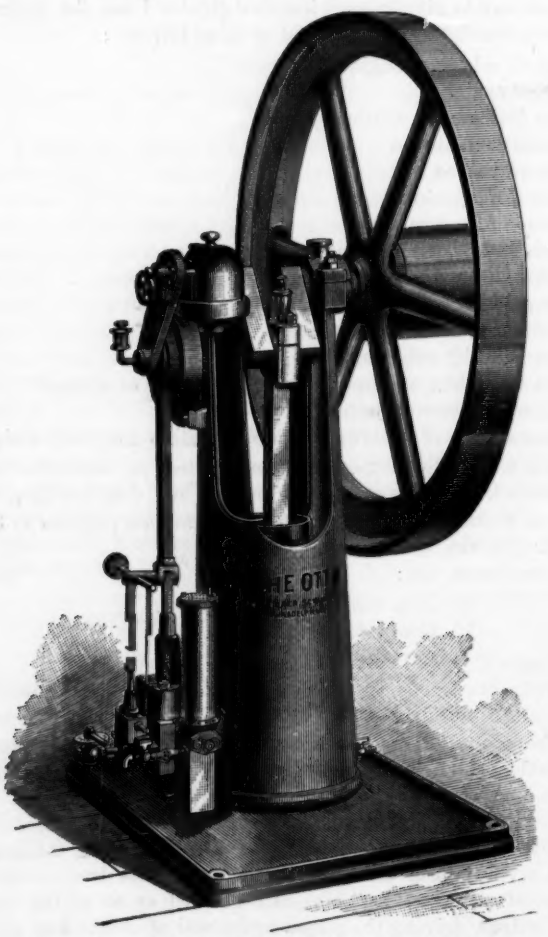


Fig. 2.—Small Size Otto Engine; Vertical Type.

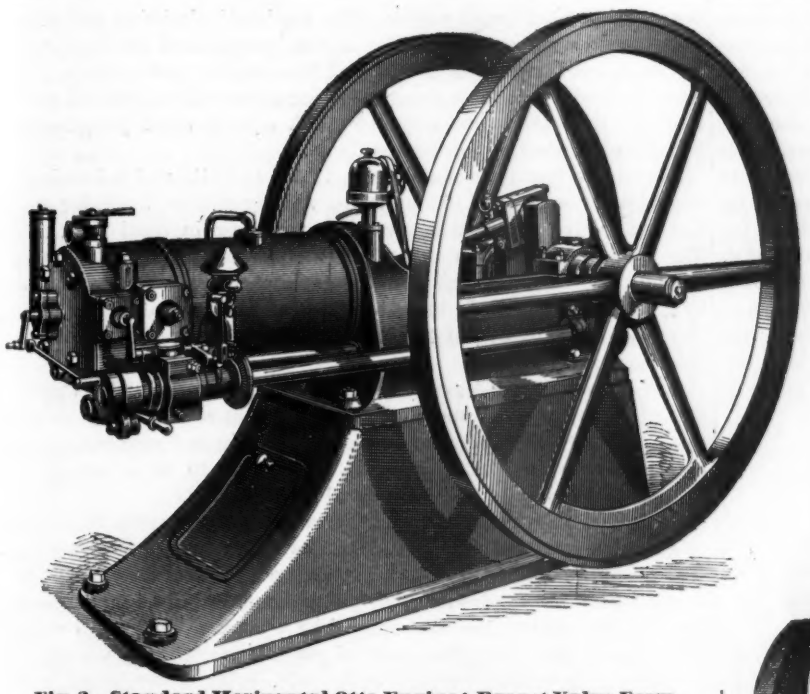


Fig. 3.—Standard Horizontal Otto Engine; Poppet Valve Form.

being advertised as the "Otto Silent Gas Engine." It was unsafe to run it over 35 revolutions per minute, and mechanically, moreover, the wear and tear was great. The action was manifestly an undesirable and dangerous one for motors of any size. The slide valve, flame ignition and water cooling jacket were all features as usual. In size it ranges from 1 H.P. to 3 or 4 H.P. A few may still be found in the United States. One is at Sibley University as a "curio."

A full description of this engine may be found in "Masterpieces of the Centennial," Vol. III., pages 42 to 46, of part 2, by J. M. Wilson, to be found in most public libraries. Also in the text books.

The Otto.—The above engine was quickly succeeded by the well known Otto. Whatever may be said as to other points, there is no doubt whatever but that the Otto has been undisputedly the leading engine upon the American market; finely constructed, practically silent, reliable and efficient, it has been kept to the fore by the constant concentration of the makers, to invariably put out the best engine that it was possible for them to design and build. In design it varies but little now from the form of 15 years ago. About the only changes have been the substitution of poppet valves and tube and electric ignition for the early slide and flame, and modification of the governor and other details. The Otto cycle is of course the feature. Regulation is by omitting charges, though sometimes by dilution. The valve gear is actuated by bevel gear from the main shaft and suitable cams and levers.

Designed by Dr. Otto in Germany, it was put on the American market in 1877, by Messrs. Schleicher, Schumm & Co., who have gradually developed until they now operate a large factory, devoted entirely to the make of this engine, at 33d and Walnut streets, Philadelphia. First made in small sizes, it has gradually grown to 60 ind. H P., which size is again arranged in double cylinder form, giving 100 brake H.P. Numerous special forms have been designed also, arranged for operating a pump, or a dynamo on same bedplate, for handling natural gas, gasoline, etc. The illustration shows three typical engines, viz.: The small vertical form, the medium size poppet valve standard, and the 50 H.P. horizontal, of which a very considerable number are now being used by gas companies for electric stations. There are now in the United States over 4,000 Otto engines in use, aggregating, probably, 30,000 to 35,000 H.P. Despite the claims of competitors of "complexity," "expensive construction," etc., etc., and better efficiency for their own engines, it is doubtful if on the whole there has been offered any superior engine. Current sizes are as follows: Vertical, ½ to 2½ ind. H.P.; horizontal, 4 to 50 H P.; and horizontal with double cylinder, 16 to 115 H.P. nom. Extended description may be found in Robinson & McGregor's books, and of the vertical form in Progressive Age for Sept., '87; of the engine and dynamo, Progressive Age for Dec. 15, '88; of engine and pump, in Light, Heat and Power, Dec., 85; horizontal 1 H.P., Am. Gas Light Journal, Jan. 16, '83; engine and refrigerating plant, Am. Gas Light Journal, April 16, '87, etc., etc.

Fig. 5.—Sombart Non-Compression Gas Engine.

The Sombart.—This engine is in reality the foreign Bischopp of the Sombart form of construction. It is one of the earliest, appearing on the American market in 1882 or 1883. It was made in Hartford, Conn., and handled by the Sombart Engine Co., then of 211 Center street, New York. Quite a number were put on the market.

About the most that can be said of it is that it was a cheap, handy

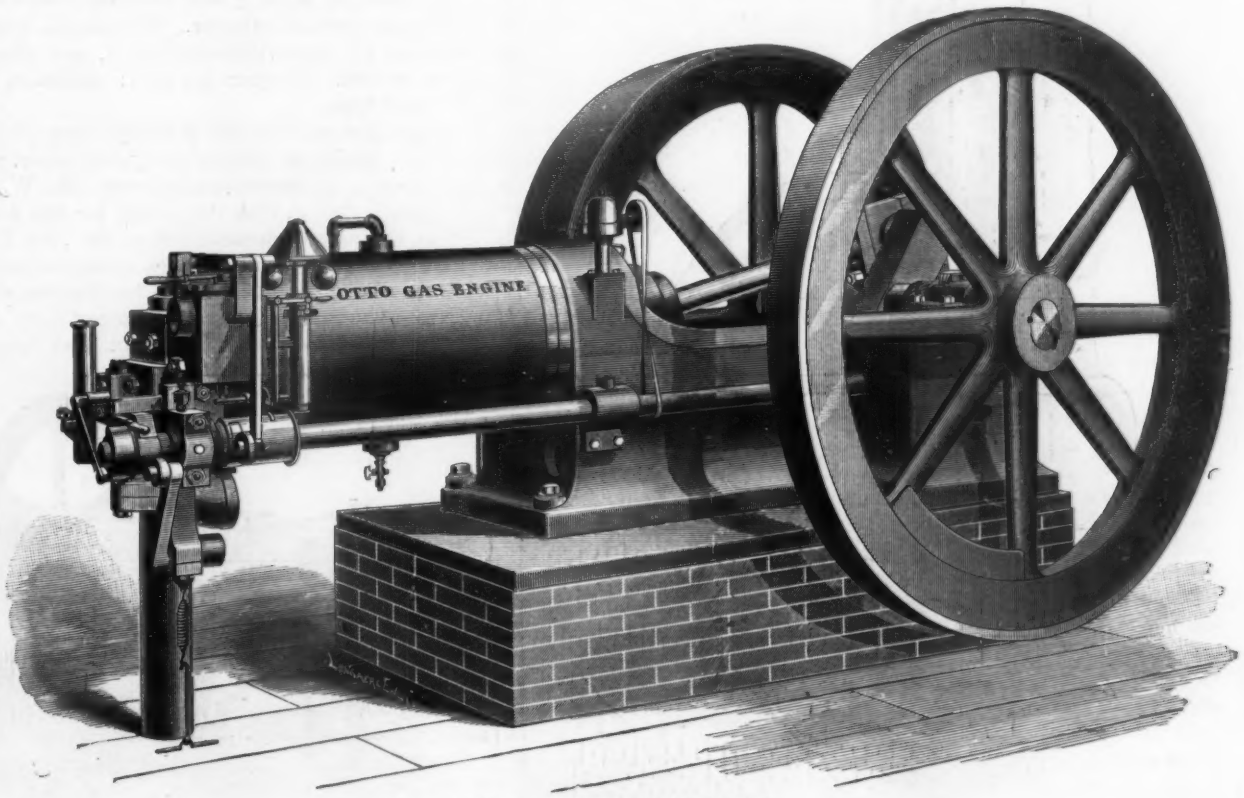


Fig. 4.—Fifty H.P. Otto Engine.

little motor for small powers, simple and uneconomical. It is a direct acting engine, without compression, and rather noisy. Its chief peculiarity, perhaps, was an "off center," so to speak, arrangement of flywheel and connecting rods in such fashion that during the impulse the greatest pull was available on the crank without side strain on the bearings. During the return no-power stroke a wide sweep of these parts was immaterial. Small powers only were made (in five sizes, from ¼ to 3 H.P.), and cooling was effected by numerous radial radiating ribs that also added stability to the engine. Relatively, but little oil for lubrication was required. Sombart's design covered a gas regulator, protection from the flame to the admission valves, and several mechanical betterments. The valve is of piston form worked by eccentric and rocker arm, with flame ignition. The consumption in this motor was at the rate of 80 to 120 cubic feet per H.P. It has long since been entirely superseded by other later engines. Full descriptions are given in the text books.

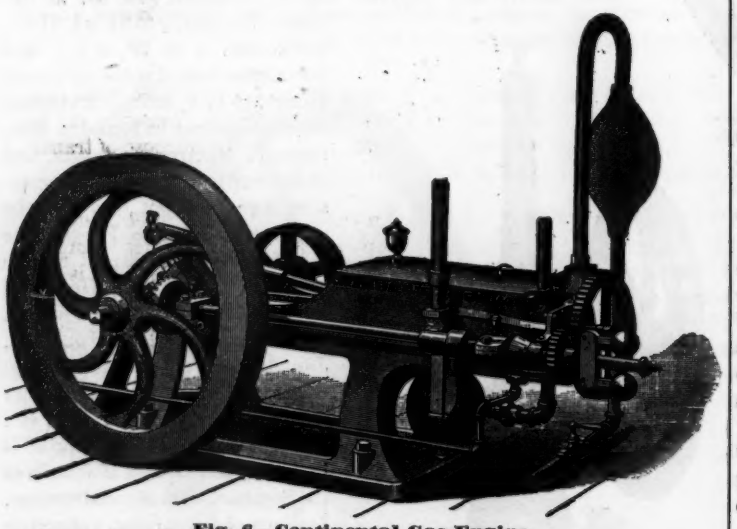


Fig. 6.—Continental Gas Engine.

The Continental.—Another of the early engines on the United States market is that known as the "Continental," brought out by the Continental Gas Engine Company (and made by the Delamater Iron Works Company) of New York, in 1883. Constructed under the "Gaume and other patents," it was a cheap edition of the typical small horizontal

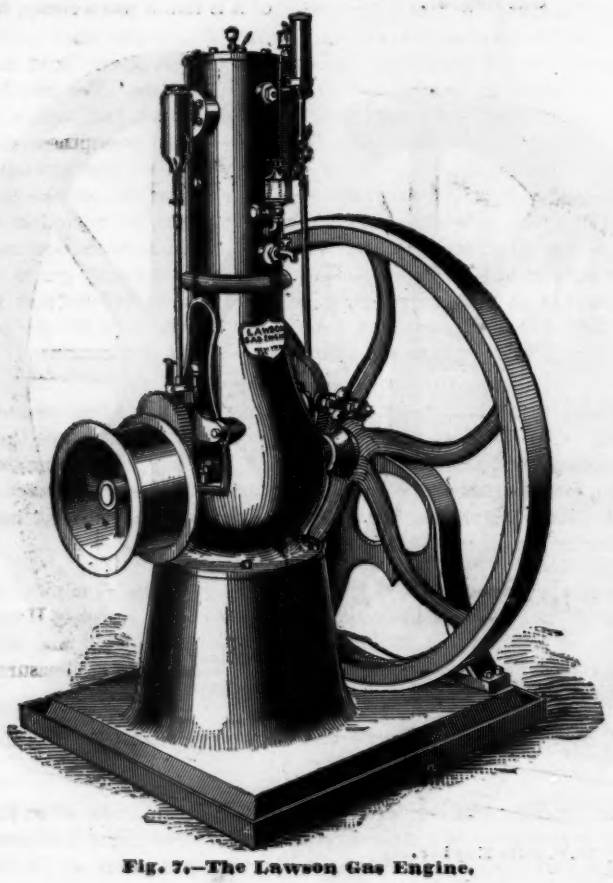


Fig. 7.—The Lawson Gas Engine.

compression (Otto cycle) engine. The combined admission and exhaust valve was a circular plate or disc, driven by cogs and bevel gear from the shaft, concentric with and located against the rear cylinder heads, having suitable apertures communicating at the proper point of revolution with the interior of the cylinder. A square water jacket encased the cylinder; the ignition was by flame.

The engine was made in sizes of ½, 1, and 1½ H.P., and a hundred or two possibly were used, chiefly in the vicinity of New York, for pumping and driving coffee mills, etc. Some are now in local junk shops. The operation was such that there was probably a loss of fresh gas through the exhaust, and the chances are that the rotary plate disc valve gave trouble. It has now long since been out of the market. Henry J. Davison, Jr., of 45 Broadway, New York, can give further information.

The Lawson.—The Lawson engine seems attractive to the writer as one of those accepted standard machines that satisfactorily do their work, and are regularly made and sold year in and year out, without pretentiousness, but with apparent satisfaction to both makers and the users, as a simple, well built, good grade engine.

Outside of New York and vicinity it is scarcely known, but in that neighborhood the makers claim, since its design by Mr. Samuel Lawson, and introduction in 1883, to have put out 1,000 or more, chiefly for confectioners' use for freezing, for pumping and kindred semi-domestic powers. In appearance it is more like a conventional small vertical steam engine than any other make of gas engine excepting possibly the "Pacific." In action it is the Otto cycle, using water jacket, a gear driven balanced piston valve, an ordinary ball governor for omitting charges, and tube ignition. In size it is made from ¼ to 15 H.P., and in twin form to 30 H.P. Special pumping forms are a feature. The address is Welch & Lawson, 203 Center street, New York. It is actively on the local market. No special description nor figures of efficiency are published as far as I know.

The Clerk.—The Clerk gas engine is of more than usual interest to the gas fraternity, in having been taken up by one of the well known members of our Association, who, a firm believer in the worth of gas engines, made a strong effort to introduce it upon the American market.

The engine itself is after the design of Mr. Dugald Clerk, of England (1881), who has, as is well known, given a great deal of study to the proper design of the theoretically correct gas engine. Acting on the basis of an impulse every revolution, the Otto cycle was abandoned, a separate auxiliary "displacer" cylinder being used, with piston driven by a rod from a pin or one of the flywheel spokes. The charge, measured and drawn into the displaced cylinder, is slightly compressed and then fed into the power cylinder, driving out the products of combustion ahead of it, and is finally compressed by the power piston. This engine is usually accepted as the type of the class of one cycle gas engines using a separate compression cylinder. The ignition is by flame, a small slide valve driven by eccentric controlling it, and also cutting off the gas supply as needed. No gears are used; admission and exhaust valves are of poppet type.

In competition with the Otto it showed very efficient and satisfactory results, and, having an impulse every revolution, promised to be an important factor in the gas engine business. Mr. W. W. Goodwin, being well impressed with it, took its control for the American market, and in 1883 an engine was on exhibition at the New York American Institute Fair. Tests in '85 with the Otto, under the same auspices, indicated a slight superiority in gas consumed for effective work, in regularity of firing, etc. The comparative results appear in the advertisement of the Clerk Gas Engine Company, in the Am. Gas Light Journal, under

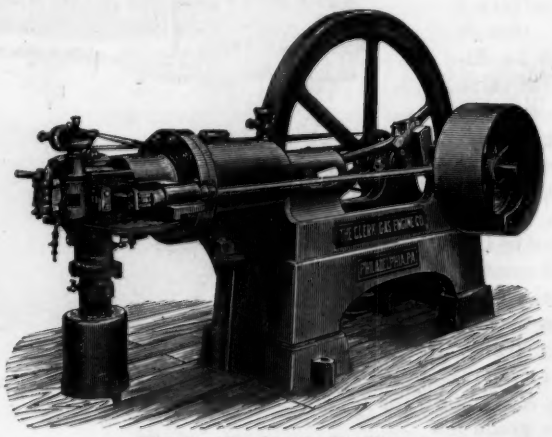


Fig. 8.—Clerk Gas Engine.

date of 5, 17, '86. Upwards of 100 engines, ranging from 5 to 30 H.P., were put upon the market, but mechanical weakness of design appeared in the English pattern (which had been represented as perfect), in the hard, matter of fact, eveyday use, which ultimately put the engine in bad repute. Mr. Goodwin at once re-designed the detail, covering an improved governor, a self-starter, less weight and noise, and the mechanical defects alluded to; but the engine had by that time gotten a bad name from those first installed, and that, coupled with the illness of Mr. Goodwin, preventing active push, has practically caused it to drop entirely out of the market. A description of the engine may be found in the AM. GAS LIGHT JOURNAL for Nov. 17, '84; also in full detail in the text books referred to in this paper.

The Parker.—This engine, brought out in 1884 by the Yonkers Mfg. Company, Yonkers, N. Y., was one of the first to use electric ignition, and also to be pushed for the use of gasoline gas. Working on the Otto cycle, with the usual water jacket, bevel gear and cam actuated poppet valves (thus doing away with the slide valve), it seemed as

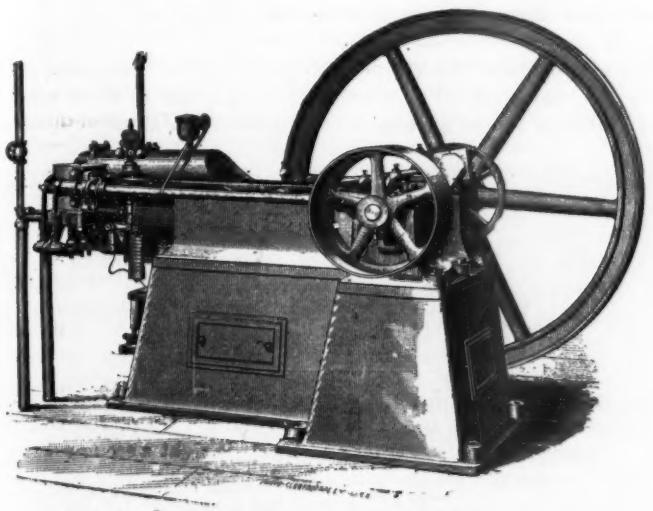


Fig. 9.—Parker Gas Engine.

though it should have some measure of success. For some reason unknown to the writer, however, it dropped out after comparatively few engines had been put in use in New York and vicinity. The sizes advertised were 2 to 10 H.P., and an efficiency of 20 to 22 feet claimed. A governor was a feature, in which the speed of the engine while in operation could be varied by the addition of weights, from 80 to 200 revolutions per minute. The electric spark was generated by a diminutive dynamo, driven by cord from the flywheel. The general effect of the engine was attractive, as may be seen from the cut. Advertisements of it ran in 1883-4 in all the gas journals.

The Stockport.—This form of English engine was taken up by the Dickson Mfg. Company, of Scranton, Pa., and put on the American market in 1885. It is of the type using a separate compression cylinder and firing every revolution. This cylinder is located axially, or on a line with the power cylinder—the two pistons being rigidly connected—and serves as a pump to force in the charge for the succeeding impulse. It is said, however, that this charge, driving out ahead of it the products of combustion of the preceding explosion, lost part of its strength at the same time, and that disappointment was experienced over a higher rate of gas consumption than the Otto or similar makes, or than was expected. This was a chief reason for the later dropping of it by the American makers. Otherwise, a sample engine on exhibition in Philadelphia seemed to the writer peculiarly attractive, from its neat appearance and smooth and quiet operation. A novel governor was a feature, regulating

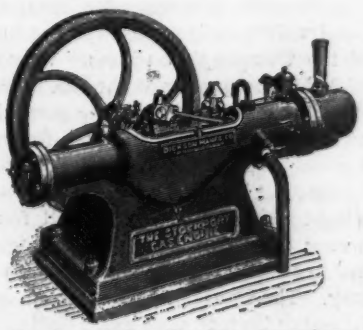


Fig. 10.—Stockport Gas Engine, American Form.

by skipping charges, like the Otto; its work has been criticised. No cams or gears were used—a slide valve and tube ignition were used. It was catalogued in both vertical and horizontal form, in sizes from 1 to 10 H.P. In Stevens Institute tests the 2 H.P. nom. developed, at 180 revolutions, 3 brake H.P., with a consumption of 31.26 cubic feet, which on this small size was certainly satisfactory work. In England its general record has been materially better. A well-known gas firm, handling it in numerous other and better forms, have there made it one of the prominent engines. For full description, see Robinson's work, pp. 185–191.

[To be continued.]

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

MR. W. H. TAYLOR, formerly connected with the Municipal station of the Consolidated Gas Company of this city, and afterwards engaged in the West in the exploiting of a patented process for making gas, has been appointed Superintendent of the Suffolk Gas Light Company, of Bay Shore, Long Island.

THE steamer Bawnmore, with a carrying capacity of 3,000 tons, has been chartered by the American firm of Messrs. W. R. Grace & Co., to ply between San Francisco and Payta, Peru, for the purpose of transporting South American petroleum to San Francisco.

WE are indebted to Mr. A. C. Humphreys, General Superintendent of the United Gas Improvement Company, for a copy of a neat pamphlet bearing the title "Economical Use of Gas for Light," which is intended for free distribution amongst the numerous consumers of the U. G. I's. many branch companies. The pamphlet, which has 12 pages between its covers, contains 8 handsome illustrations showing the difference between the correct and incorrect shapes of gas flames, or as the latter should or should not be when in duty in the hands of the consumers. The descriptive text is simple and to the point, and is so compiled that even the queen of the kitchen can comprehend the economical lesson it teaches almost as readily as can her employer.

ON the 6th inst. the proprietors of the Vallejo (Cal.) Electric Light and Power Company (the concern has been virtually insolvent for some time) petitioned the Superior Court for the privilege of selling the property at auction. The petition was granted, but a day has not yet been named when the sale shall take place.

ON the 6th inst., Messrs. Charles D. Hauk and Henry McGurren, of Chicago, and Fred. Morrill, of Kansas City, Mo., petitioned the City Council, of Kansas City, for a franchise to operate a gas works. The ordinance accompanying the petition provides that a gas shall be furnished 5 cubic feet of which shall produce a 22 candle power light, suitable for illuminating, heating and mechanical purposes. The rate that may be charged shall not exceed $1.40 per 1,000 cubic feet, with a deduction of 15 cents per 1,000 if the bills are paid with promptness each month, until the gas sales shall equal 200,000,000 cubic feet annually; when the annual output reaches 400,000,000 cubic feet the net rate is to be $1.15 per 1,000; when the output reaches 800,000,000 cubic feet the net rate is to be $1.05 per 1,000, and when the output is one billion cubic feet the rate is to be $1 per 1,000. They also offer to supply gas to the public lamps on the moonlight schedule at the rate of $12 per post per annum, the rate for all night and every night lighting to be $15 per post per annum. The ordinance was referred to the Gas Committee.

MR. HAUK, in speaking about this move in Kansas City to a reporter for a local daily, said that in case the ordinance passes, the home Company (which is the National Gas and Water Company, of Chicago), will organize a local Company for Kansas City and begin work at once on the plant. He is negotiating for a suitable site and will build a large works, modern in all its equipments.

AT the annual meeting of the Harrisburg (Pa.) Gas Company the following officers were chosen: Directors, Charles H. Bergner, Henry A. Kelker, W. K. Alricks, J. D. Cameron, George W. Reily and Wm. F. Bay; President, W. F. Bay; Secretary, J. Wesley Awl; Treasurer, F. A. Awl.

MR. C. H. DUNBAR is now Superintendent of the American Gas Company's plant at New Rochelle, N. Y.

OUR item columns for last week contained a hint to the effect that certain representatives of the Great Western Fuel Gas Light Company, of Chicago, had applied for the right to operate a gas plant at Topeka,

Kansas. Since that mention was made we have received the following account of what has been said by "Gen." A. B. Campbell respecting the proposed Company—the "General" is the General Agent of the Great Western, etc.: "The gas which we propose to introduce is an absolutely fixed gas and has been subjected to a temperature of 22° below zero, with no apparent change. It is made by a new process, having crude oil as its basis, and has the two essential elements of first class gas—quality and cheapness. Tests of all kinds have been made at Liberty, Indiana, upon which the guarantees of this Company are based. The apparatus for making this gas has been patented, so the gas we make is not made by any other Company, excepting one, in the United States, and it is the parent Company from which we derive the authority to use these inventions. Tests have been made which show that our gas has 15 per cent. greater heating energy than natural gas possesses, and we boldly make the assertion that this gas has a greater heating quality than natural gas or any other gas made in the United States or elsewhere. It has a candle power of 22.65, and is a brighter, cleaner and better light than any coal gas that is made. The original plant for making this gas is at Liberty, Ind., which city is generally piped with gas for light and fuel. The plant is in successful operation in that city and the gas is used in every form for light and heat. The people who use it there say it is demonstrated beyond a doubt that this gas at $1 per 1,000 for lighting purposes is cheaper than coal oil at 15 cents per gallon, and that at 80 cents per 1,000 for fuel it is cheaper than coal or gasoline. The apparatus for manufacturing the gas is simple and with but little instruction one man can operate the entire plant. It is safe and can be erected ready for use for one-half the sum that would have to be expended in the construction of an old-fashioned plant. The original Company for the construction of this apparatus is the Central Fuel Gas and Electric Company, of Indianapolis, Ind., and that Company I represent controls the territory east of the Mississippi river. The Great Western Fuel and Gas Light Company, of Chicago, controls the territory west of the Mississippi river, and is the Company with which Topeka is invited to do business. It has a capital of $500,000, and is amply able to carry out any contract that it may make with the city. It is proposed to erect a plant in Topeka and demonstrate the facts herein stated before asking the city to make any contract whatever. After the demonstration has been made we have no doubt that the city will join hands with us."

ACTING under the order of Judge Woolson, who decreed that a special election of the shareholders in the Iowa City (Ia.) Gas Light Company should be held on the 9th inst. to fill the vacancies in the Company's Board of Directors, the election was held. The same, however, resulted in failure, owing to the inability of any of those named to secure a majority of the votes cast. The election was postponed to the second Monday in January, on which date the regular annual election occurs. It is thought by that time the Company will have no difficulty in perfecting an organization.

BIDS for lighting the streets of Modesto, Cal., by either gas or electricity, and on an all night and moonlight schedule, respectively, will be opened on Thursday next. The contract period is for one year from December 1st, next.

A CERTIFICATE announcing the incorporation of the Canisteo Electric and Fuel Gas Company, "to manufacture gas and electricity for use for public and private purposes" in Canisteo and Hornellsville, N. Y., has been filed. The incorporators are: Wm. G. Porter, Levi S. Davis and Wm. T. Bailey, of Canisteo; W. H. Harris, Washington, D. C.; John W. Trim, of Brooklyn; and John W. Farquhar, of Buffalo. It is capitalized in $50,000, and it looks to be something on the order of the celebrated plant at Maysville, Ky. All that is necessary is that those who are asked to invest money in this scheme should hunt up the antecedents of Mr. Harris.

IT seems that the E. C. Perry & Co. gas works, of Dunkirk, N. Y., is to be reorganized on the basis of a regular stock company, for such is the inference we draw from the recent filing of a certificate incorporating the Dunkirk Gas and Coke Company, "to manufacture and supply gas for public and private purposes in the city and town of Dunkirk." The Directors are Messrs. Edward C. Perry, Chas. D. Armstrong and Louis J. Fleischman, of Dunkirk, all of whom are interested in the E. C. Perry & Co. gas works.

THE following from a local source concerning the gas supply of Toronto, Canada, is of interest: "The first gas works were erected in Toronto in 1842, by Mr. Albert Furniss, who also built the water works. The Consumers Gas Company was formed in 1847, and the first meeting of its subscribers was held October 29th, 1847, when the Directors were elected. The Directors had only organized when they found they could purchase the plant of the original concern, which they did. The first Directors were Messrs. Charles Bezczy (President), Hugh Miller, John T. Smith, D. Patterson, J. Arnold, M. Bettly, I. C. Gilmour, W. Mathers, S. Alcorn, E. C. Hancock, S. Platt and James Strange. When the Company took over the plant the price of gas was $5 per 1,000 net, besides a considerable meter rent. On September 30th, 1847, the total number of street lamps was 164 and the customers numbered 316. The first Manager was Mr. John Watson. He was succeeded by Mr. Henry Thompson, who was succeeded in 1874 by the present Manager, Mr. W. H. Pearson. The output of gas in 1842 was 1,146,000 cubic feet; in 1891 it was 500,414,000 cubic feet."

THE Common Council of Newburyport, Mass., has adopted a resolution requesting the Mayor to petition the proprietors of the local Gas and Electric Light Company to reduce the selling rates.

THE proprietors of the Kennebec Light and Heat Company, of Augusta, Me., have ordered a reduction in the gas rate to $2.50 per 1,000 cubic feet from $3, the concession to take effect on January 1st, 1894.

RECENT press despatches are to the effect that about a fortnight ago a combination of all the natural gas companies in the Lima district of Ohio was formed. Senator Calvin S. Brice is largely interested in the scheme, as is Mr. S. A. Baxter, of the First National Bank, of Lima, who has been elected President of the combination. It is understood that gas will be piped from Indiana to supply the Ohio systems, the supply of that State having been greatly depleted.

THE Edison Electric Light Company, of Meridian, Miss., has made an assignment for the benefit of its creditors. No preferences were made. Messrs. C. W. Gallagher and J. H. Wright were appointed assignees. The works were shut down for 24 hours, but were put in work at the end of that time. The Company has a contract for lighting the city.

SOME days ago Superintendent Curley, of the Wilmington (Del.) Coal Gas Company, was visited by Prof. Berlin and 24 pupils of the Boys' High School, who inspected the plant from beginning to end. The "boys" plied Mr. Curley with numberless questions, but they did not "stump" him once.

THE term of office of Colonel John T. Wheelwright, who fills the vacancy on the Massachusetts Board of Gas and Electric Light Commissioners occasioned by the resignation of Commissioner Macdonald, expires on July 1st, and the wiseacres have it that the election of Mr. Greenhalge to the Governorship means that in July Colonel Wheelwright will be succeeded by a Republican.

THE full text of the decision rendered by the Massachusetts Board of Gas and Electric Light Commissioners, in the matter of the petition of certain residents of Chelsea, Mass., for a decree reducing the gas rate in that district, is appended: "On the petition of the Mayor of Chelsea, and more than 20 customers of the Chelsea Gas Light Company, for an improvement in the quality of the gas and a reduction in price of gas to $1.50 per 1,000, and in the price of electric light, public hearings were given to the parties interested, in the City Hall in Chelsea. The petitioners and the Company were represented by counsel. After this petition was filed with the Board, but before the hearing was ordered, the Company voted to reduce the price of incandescent lighting to 1 cent per lamp hour, and this price went into effect on the 1st day of July last. At the hearing the petitioners expressed themselves as generally satisfied with this, and waived their request for any further reduction in that department of the Company's business. Very much of the evidence submitted related to the quality of the gas. From the reports of the State Inspector it appeared that the candle power had been invariably above that required by the statute, and that, for more than a year, the Company had in only a single instance failed to comply with the provisions of law respecting impurities. There nevertheless was much complaint of poor light which seemed to be well founded. The testimony showed, however, that this did not exist through the city generally, but was confined to a limited area upon both sides of the mercantile portion of Broadway. The trouble was evidently a local one—a complaint of poor light rather than of poor gas. Early in the hearing the

Board became satisfied that this was due to a lack of pressure in certain mains, the capacity of which was not sufficient for the territory they were intended to supply. The Company recognized this fact, and before the hearing closed purchased for this section additional pipe, which has been laid and is now in use. This new main is believed to be fully equal to all the demands likely to be made upon it. If the consumers within the territory referred to shall now fail to secure sufficient gas, it will probably be found that the trouble is caused by defective piping or fixtures upon their own premises. In considering the request for a reduction in price of gas it is necessary to note that in answer to a former petition against this Company, the Board, in 1891, fixed the price at $1.80, and that this price went into effect July 1 of that year. The report accompanying the decision showed that this price was made after an exhaustive examination of the entire history and affairs of the Company. The Board was then of the opinion that the cost for management and distribution, as well as the capital charge, might be reduced, and suggested to the Company the necessity of improving its plant and the expediency of a temporary reduction in its rate of dividend. The price in fact was fixed at a point which was intended to compel the introduction of improvements in the works and economies in the management. The Board is now asked again to examine the affairs of the Company and determine whether, owing to new conditions, or otherwise, another reduction may fairly be required. At the hearing the desire for this was strongly expressed, but very few facts or arguments were presented by the petititioners. The Company protested, submitted its records and accounts, and urged that another reduction at this time would be neither reasonable nor just. The amount of output is a most important factor affecting the cost of gas to the Company and the price to the consumer, and it seems neither fair nor just to demand the same prices for Chelsea as prevail where the output is from three to five times as great. It was urged by the petitioners that a lower price would secure a much larger output for the Company. The same proposition was urged at the former hearing. This is usually the rule, and the Board seemed to be warranted in assuming that it would be the case in Chelsea, and this factor was influential in fixing the present price. This expectation, however, has not been met in the case of this Company. In the five years prior to July 1, 1893, the Company has reduced the price of gas nearly 20 per cent., but the increase in the output during the entire period has been only 2 per cent. The last reduction went into effect on July 1, 1891, and the output for the year following was in fact less than for the preceding year. During the period named the profits have steadily diminished, and for the year ending July 1, 1893, were about $10,000 less than for the year ending July 1, 1888. There is but one city in the State of similar size where the consumption of gas is so small, although in some of them the price is as high or higher. These facts are important and compel serious consideration. They afford strong ground for the Company's position that the field which is occupied is governed by exceptional conditions. It is difficult for the Board to understand or account for this, and no attempt to explain it was made at the hearing. There was no criticism upon the attitude of the Company toward its consumers, but the witnesses were agreed that it had been courteous in its treatment and attentive to the complaints of its customers. In the performance of this duty to the petitioners and in view of the earnestness of their request, the Board has carefully examined the methods now employed by the Company. After a careful scrutiny of its accounts, it is satisfied that they correctly exhibit the Company's transactions and condition. It is apparent that any reduction from the present price can only be secured through some decrease in the cost of production or distribution of the gas. In the cost of distribution and management no extravagant expenditures for salaries or other items are included, and this department seems to be conducted in a legitimate and economical manner. There is no reason to believe that these items could be appreciably reduced by any change of management. The Board believes, however, that the cost of manufacture may be somewhat reduced by a closer and more intelligent attention to that portion of the business. It finds that this has been increased by a percentage of leakage or loss of gas, much greater probably than would be allowed under careful management. It was claimed by the Company that much of this was due to the extraordinary interference with the Company's pipes by the construction of sewers. If the loss be due to this fact it is not likely to be repeated; and if it is due to lack of proper supervision, the burden of it should not be borne by the public. Included also in the cost of gas for last year is a considerable sum for extraordinary repairs and improvements. No similar call is likely to occur in the immediate future. Some saving must therefore accrue from an improvement in these two features of the Company's business, and this gain, although of necessity small, may properly accrue to the public. The ratio of capital to output in the Chelsea Company is much higher than in other Companies of a similar size in the State. This is largely attributable to the imprudent policy pursued by the Company in former years in relation to the issuance of stock, as was pointed out in the report of this Board alluded to above. The over capitalization resulting from this policy should not be permitted to operate as a medium of burdensome dividend charges; this may be obviated in a large degree by a price which contemplates a low rate of dividends. The reduction proposed is based upon these considerations. The Board recommends that on and after the first day of January next the price of gas supplied by the Chelsea Gas Light Company shall not exceed $1.65 per 1,000 cubic feet."

At a recent meeting of the Select Council of Philadelphia a motion (introduced by Mr. Brown) for a committee of five members from each Chamber to investigate the condition of the city's gas plant and suggest improvements was adopted. The five named from the Select Chamber are Messrs. Brown, Bringhurst, McCoach, Hetzel and Ryan; a committee that collectively knows very little about the matters which are to be considered.

You may stagger the Brooklyn, N.Y., Board of Aldermen, but you cannot completely unhorse them. The 1894 Board will be overwhelmingly Republican, but the Democratic Board of 1893, which has just been voted out of office, has called for bids for the public lighting for 1894, and the present Board will undoubtedly *try* to award the contract. Hitherto, or when the "boys" had things their own way, the contracts were never disposed of until March, or even later.

At the meeting ot the Society of Gas Lighting for November, a special committee was appointed to make a suitable memorial minute to the late Mr. Wm. Combe, ex-Treasurer of the Society. The memorial adopted is appended:

The members of the Society of Gas Lighting desire to give expression to their deep regret at the loss of William Combe, who was one of the original members of the organization, and its Treasurer for a number of years.

He was recognized by the members of the Society, and by all those with whom he came in contact, as one possessed with the high qualities of prudence, sagacity and integrity, which made him so prized and useful among his friends and business associates.

The above characteristics, with his quiet, gentle and genial manner, made intercourse with him most pleasant and attractive. The members of the Society feel with great sorrow that they have lost an active member, constant in his attendance at the meetings, and a friend of long standing.

Resolved, That this minute be entered upon the recorded minutes of the Society, that a copy be sent to the family of the late Mr. Combe, and that this action be published in the American Gas Light Journal.

Eugene Vanderpool,
Wm. H. Bradley,
Wm. R. Beal,
} Committee.

As said before in the Journal, the Commissioners appointed by the Supreme Court under an act of the Legislature of Massachusetts, to report on the market value of the property of the Bay State Gas Company, not including in their award the value of the franchises of the Company, filed their findings early in the month, and the same were formally read in Court by Judge Lathrop. The Commissioners value the plant at $2,000,000, which estimate was arrived at after much close examination. Ten hearings were held at which the attorneys for the Gas Company, Messrs. Chandler, Russell and Putnam, and Corporation Counsel Babson, for the city, put in a vast amount of evidence by deposition and by expert engineers. The contention of the city was that under terms of the act of the Legislature leaving out the value of the franchises, that the Commission could only make an award covering the structural value of the works and the value of the land. The attorneys for the Company proved by the experts that if the Company was to be valued as a commercial concern, based on its earning capacity, that 4 to 5 millions of dollars would not be an excessive valuation. The city called as one of its witnesses Mr. Barker, of the Gas Commisssion, to testify as to the value which he had placed on the structural value of the property when the Commission reduced the price of gas to $1 per 1,000, and he testified that this value was between $1,500,000 and $2,000,000. Some days after an order was issued by Justice Lathrop in the equity session of the Supreme Court, accepting the report of the Commissioners, at their valuation. All parties to the contention, including Mayor Matthews, accepted the result.

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

EDITOR—Jos. R. Thomas, C.E.
ASST. EDITOR—T. J. Cunningham.
MANAGER—C. E. Sanderson.

PUBLISHED ON EACH MONDAY OF THE YEAR AT
No. 32 Pine Street, New York.

This is a recognized official organ of
LIGHT, HEAT, STEAM, WATER SUPPLY,
VENTILATION, SANITARY IMPROVEMENT,
AND GENERAL SCIENCE

MONDAY, NOVEMBER 20, 1893.

The Market for Gas Securities.

During the week the market for city gas shares was quite restricted, and the quotations for Consolidated were on the lower scale, with the opening to day (Friday) at 134 bid, sellers holding out for 135. This is something over one-half point below the rating of last writing. Meantime there is no reason why the stock should be weaker; in fact, there is every reason that it should be higher. Equitable moved up sharply, the substantial gain of 20 points being recorded for the week's transactions. It is in demand at 190 bid, to 195 asked. Mutual holds the advance recently reported, and Standard is also in some request.

Brooklyn shares are improving, notably so in the instance of Metropolitan, for which 126 is bid. There is no change in the situation there, unless it is that a move in Equity ought to be recorded very soon. Chicago gas is stronger to-day, the opening having been made at 62¾ to 63. A strong pool must exist in this stock, with the evident understanding that 60 is to be the minimum price for the present. Baltimore Consolidated is offered at 57, which is rather odd in the face of the declaration of a 2½. per cent. dividend. Laclede preferred is quoted at 66 to 68. The dividend on these shares of 2½ per cent. is payable on the 15th December. Detroit bonds are bid 45. We note a sale at auction this week of 400 shares Mutual, N. Y., at 145 to 145¼. Bay State is a trifle stronger, at 17 to 17¼.

Advertisers Index.

GAS ENGINEERS. Page

Jos. R. Thomas, New York City ... 745
Wm. Henry White, New York City ... 751
Fred. Bredel, New York City ... 747
H. C. Slaney, New York City ... 745
Geo. R. Rowland, New York City ... 745
Jas. R. Smedberg, Chicago, Ills ... 745

CHEMISTS.

E. G. Love, New York City ... 742

PROCESSES.

Bartlett, Hayward & Co., Baltimore, Md ... 749
United Gas Improvement Co., Phila, Pa ... 741
Burdett Loomis, Hartford, Conn ... 751
National Gas and Water Co., Chicago, Ills ... 743
Economical Gas Apparatus Construction Co., Toronto, Ont. 742
The Western Gas Construction Co., Fort Wayne, Ind ... 742

GAS WORKS APPARATUS AND CONSTRUCTION.

James R. Floyd & Sons, New York City ... 751
Continental Iron Works, Brooklyn, N. Y ... 736
Delly & Fowler, Phila., Pa ... 751
Kerr Murray Mfg. Co., Fort Wayne, Ind ... 748
Stacey Mfg. Co., Cincinnati, Ohio ... 751
Bartlett, Hayward & Co., Baltimore, Md ... 749
Davis & Farnum Mfg. Co., Waltham, Mass ... 748
R. D. Wood & Co., Phila., Pa ... 750
Bouton Foundry Co., Chicago, Ills ... 751
Isbell-Porter Company, New York City ... 750
Fred. Bredel, New York City ... 747
United Gas Improvement Co., Phila., Pa ... 741
Berlin Iron Bridge Company East Berlin, Conn ... 738
National Gas and Water Co., Chicago, Ills ... 743
Economical Gas Apparatus Construction Co., Toronto, Ont. 742
The Western Gas Construction Co., Fort Wayne, Ind ... 742

GAS AND WATER PIPES.

Mellert Foundry and Machine Co., Reading, Pa. (John Fox, Selling Agent, N. Y.) ... 753
Ohio Pipe Co., Columbus, Ohio ... 753
M. J. Drummond, New York City ... 753
R. D. Wood & Co., Phila., Pa ... 750
Warren Foundry & Machine Co., New York City ... 753
Donaldson Iron Co., Emaus, Pa ... 753
Addyston Pipe and Steel Co., Cincinnati, O ... 753

STEAM BLOWER FOR BURNING BREEZE.

H. E. Parson, New York City ... 747

GAS COALS.

Penn Gas Coal Co., Phila., Pa ... 745
Perkins & Co., New York City ... 744
Despard Coal Coal, Baltimore, Md ... 745
Chesapeake and Ohio R. R. Coal Agency, N. Y. City ... 745
Westmoreland Coal Company, Phila., Pa ... 745
J. & W. Wood, New York City ... 744
Henry C. Scheel, New York City ... 745

CANNEL COALS.

Perkins & Co., New York City ... 744
J. & W. Wood, New York City ... 744
Henry C. Scheel, New York City ... 745

GAS ENRICHERS.

Standard Oil Co., Cleveland, Ohio ... 745

COKE CRUSHER.

C. M. Keller, Columbus, Ind ... 744

INCLINED RETORTS.

Parker-Russell Mining and Mfg. Co., St. Louis, Mo ... 746

RETORTS AND FIREBRICK.

J. H. Gautier & Co., Jersey City, N. J ... 746
B. Kreischer & Sons, New York City ... 746
Adam Weber, New York City ... 746
Laciede Fire Brick Mfg. Co., St. Louis, Mo ... 746
Borgner & O'Brien, Phila., Pa ... 746
James Gardner, Jr., Pittsburgh, Pa ... 746
Henry Maurer & Son, New York City ... 746
Baltimore Retort and Fire Brick Co., Baltimore, Md ... 746
Parker-Russell Mining and Mfg. Co., St. Louis, Mo ... 746
Brooklyn Fire Brick Works, Brooklyn, N. Y ... 746

GASHOLDER TANKS.

J. P. Whittier, Brooklyn, N. Y ... 747

GASHOLDER PAINT.

The Government Waterproof Paint Co., Boston, Mass ... 736

CEMENTS.

C. L. Gerould & Co., Brooklyn, N. Y ... 746

SCRUBBERS AND CONDENSERS.

G. Shepard Page's Sons, New York City ... 716
R. D. Wood & Co., Phila., Pa ... 750
James R. Floyd & Sons, New York City ... 752
Continental Iron Works, Brooklyn, N. Y ... 736

REGENERATIVE FURNACES.

Bartlett, Hayward & Co., Baltimore, Md ... 749
Fred. Bredel, New York City ... 747
J. H. Gautier & Co., Jersey City, N. J ... 747
Parker-Russell Mining and Mfg. Co., St. Louis, Mo ... 746

GAS GOVERNORS.

Connelly Iron Sponge and Governor Co., New York City ... 743
Wilbraham Baker Blower Co., Phila., Pa ... 743

GAS GAUGES.

The Bristols' Mf'g. Co., Waterbury, Conn ... 742

TAR AND CARBONIC ACID EXTRACTOR.

Geo. Shepard Page's Sons, N. Y. City ... 752

AMMONIA CONCENTRATOR.

Michigan Ammonia Works, Detroit, Mich ... 734

GAS METERS.

John J. Griffin & Co., Phila., Pa ... 734
American Meter Co., New York and Philadelphia ... 735
The Goodwin Meter Co., Philadelphia, Pa ... 736
Helme & McIlhenny, Phila., Pa ... 735
D. McDonald & Co., Albany, N. Y ... 735
Nathaniel Tufts, Boston, Mass ... 734
Maryland Meter and Manufacturing Co., Baltimore, Md ... 734
Harris Bros. & Co., Philadelphia, Pa ... 734
Metric Metal Co, Erie, Pa ... 733

SELF-SEALING MOUTHPIECE DOORS.

Isbell-Porter Company, New York City ... 750
Continental Iron Works, Brooklyn, N. Y ... 736

INCANDESCENT GAS LAMPS.

Welsbach Light Co., Gloucester City, N. J ... 738

BURNERS.

C. A. Gefrorer, Phila., Pa ... 736
Moses G. Wilder, Phila., Pa ... 735

STREET LAMPS.

J. G. Miner, Morrisania, New York City ... 747
Bartlett Street Lamp Mfg. Co., New York City ... 747

PURIFYING MATERIAL.

Connelly Iron Sponge and Governor Co., New York City ... 743
Greenpoint Chemical Works, Brooklyn, N. Y ... 743
Henry W. Douglas, Ann Arbor, Mich ... 743
Read, Holliday & Sons, Ltd., New York City ... 735

ELECTRICAL APPARATUS.

Wm. Henry White, N. Y. City ... 751
Fort Wayne Electric Co., Fort Wayne, Ind ... 735

EXHAUSTERS.

The P. H. & F. M. Roots Co., Connersville, Ind ... 740
Isbell-Porter Company, New York City ... 750
Wilbraham Baker Blower Co., Philadelphia, Pa ... 743
Connelly Iron Sponge and Governor Co., New York City ... 743
The Connersville Blower Co., Connersville, Ind ... 740

VALVES.

Ludlow Valve Manufacturing Co., Troy, N. Y ... 735
Chapman Valve Manufacturing Co., Boston, Mass ... 735
R. D. Wood & Co., Phila., Pa ... 750
Continental Iron Works, Brooklyn, N. Y ... 736

GAS ENGINES.

Schleicher, Schumm & Co., Phila., Pa ... 750

ENGINES AND BOILERS.

The Hazelton Boiler Co., New York City ... 737

PURIFIER SCREENS.

John Cabot, New York City ... 742

GAS STOVES.

American Meter Co., New York and Philadelphia ... 739
The Goodwin Meter Co, Phila., Pa ... 736
George M. Clark & Co., Chicago, Ills ... 737
Maryland Meter and Manufacturing Co., Baltimore, Md ... 734
The Schneider & Trenkamp Co., Cleveland, O ... 736

DIVIDEND NOTICE.

OFFICE OF THE AMERICAN GAS COMPANY,
222 SOUTH THIRD ST., PHILA., PA., Nov. 15, 1893.

The Board of Directors of the American Gas Company have this day declared a semi-annual dividend of 3 per cent., or $3 per share, on the capital stock of the Company, payable on and after Dec. 23, 1893. MORRIS W. STROUD, Treasurer.
963-3

Seven per Cent. Gold Bonds for Sale.

To enlarge our works we offer for sale $10,000 in 7 per cent. 15-year bonds, interest payable semi-annually, and secured by a first mortgage on our entire works and property, valued at $45,000. Apply to

GAS AND ELECTRIC CO.,
963-4 Santa Ana, Calif.

FOR SALE.

One Section Hydraulic Main for Bench of 5's, with Bridge Pipes and Mouthpieces.
Four Small Purifying Pans, Center Seal and Steam Jet Exhauster.
All 6-inch connections. Address
D. W. CHAMBERLIN, Supt., Hackensack, N. J.

Utilize Your Gas Liquor.
NO EXTRA LABOR OR OPERATING EXPENSES.
Ammonia Concentrators
Not Expensive. Write to
STROH & OSIUS, Pat'ees, or
Mich. Ammonia Works, Detroit, Mich.

Valuable Gas Interest For Sale,

The undersigned will sell, to the extent of $20,000 to $50,000, in sums to suit purchaser, an interest in a growing gas business now netting 8 per cent.; increase this year will give net earnings of over 12 per cent. Money wanted for extensions to cover valuable territory. A magnificent opening for a party desiring a permanent occupation and investment in one of the most pleasant residence locations in California. Banks and business firms as references. Address for particulars and statement,

LOS ANGELES SAFE DEPOSIT AND TRUST CO.,
Stimson Block, corner Third and Spring Streets.
954-tf Los Angeles, California.

Read, Holliday & Sons, Ltd.

No. 7 Platt St., N. Y. City.

HYDRATED OXIDE OF IRON

For Gas Purification.

Analysis, Samples and Particulars on Application.

MOSES G. WILDER,

Mechanical Engineer,

816-822 Cherry St., Phila., Pa.

MANUFACTURER OF

Gas Governors,

Governor Gas Burners,

Gas Cocks and Fittings.

In addition to a full assortment of Volumetric Governors, etc., I am now making **MERCURY PRESSURE GOVERNORS** of all the usual sizes, adapted to use upon *Gas Stoves, Furnaces, and Meters.* The same careful attention to details of design and workmanship which has established the reputation of **WILDER'S VOLUMETRIC GOVERNORS** will be given to the new line. They have been thoroughly tested in many places during the past year, and have given entire satisfaction. The price is very low, and but for a complete system of machinery adapted to this work, it would be impossible to sell them at the price. I hope for large orders, as they become known, in consequence of the low price and good quality.

THE

LUDLOW VALVE MFG. CO.,

MANUFACTURERS OF

VALVES,

Double and Single Gate, ¾ in. to 72 in., outside and inside Screws. Indicator, etc., for Gas, Water, Steam, Oil and Ammonia.

SEND FOR CIRCULAR.

SEND FOR CIRCULAR.

ALSO,

Hydraulic Main Dip Regulators, Check Valves, Foot Valves, Yard Wash and Fire Hydrants.

OFFICE AND WORKS:

938 to 954 River St., & 67 to 83 Vail Av.,
TROY, N. Y.

CHAPMAN VALVE MANUFACTURING CO.,

MANUFACTURERS OF

Valves and Gates for Gas, Ammonia, Water, Etc.

Also, Gate Fire Hydrants with and without Independent Nozzle Valve. All Work Guaranteed.

Works & Gen'l Office, Indian Orchard, Mass. Treasurer's Office, 72 Kilby & 112 Milk Sts., Boston, Mass.
Chicago Office, 24 West Lake St. New York Office, 28 Platt St.

FORT WAYNE ELECTRIC CO.

FORT WAYNE, IND.

Arc Lamps for Railway Circuits.

"WOOD" RAILWAY GENERATORS.

This Company is manufacturing a new Arc Lamp for use on 500-volt Railway Circuits. These lamps are run nine in series, and have embodied in them all the good features contained in our regular series lamps. They give a satisfactory and steady light, and are being ordered in quantities by other manufacturers of lighting and railway apparatus.

The "Wood" 160-H.P. 500-Volt Railway Generator has been running on an over-load twenty-four hours every day without interruption for four weeks, furnishing power for the tests made by the several Committees on Awards at the World's Columbian Exposition.

In awarding this Company medals for successful competition upon the apparatus which it presented for comparative tests at the Columbian Exposition, the following reasons, among others, are given:

"For excellent mechanical construction."
"Close regulation to constancy of current by means of quick-acting automatic regulation."
"Capability of machines to withstand either short circuiting or open circuit without danger to dynamos."
"Capacity in excess of rating when necessity requires."
"Is worthy of award for mechanical and electrical design."
"Excellence and simplicity in operation, giving effective service."

BRANCH OFFICES:

44 Broad Street, New York City.
185 Dearborn Street, Chicago.
907 Filbert Street, Philadelphia.
52 Union Street, New Orleans, La.
405 Times Building, Pittsburgh.
Kirk Building, Syracuse.
57 East State Street, Columbus, Ohio.
41 Stevenson Street, San Francisco.

To Gas Companies.

We make to order **CAP BURNERS** to burn any amount under a stated pressure. Send for samples.

Also, SERVICE CLEANERS, DRIP PUMPS, and STREET MAIN PROVING APPARATUS.

C. A. GEFRORER,

248 N. 8th St., Phila., Pa.

GASHOLDER PAINT.

Use Only

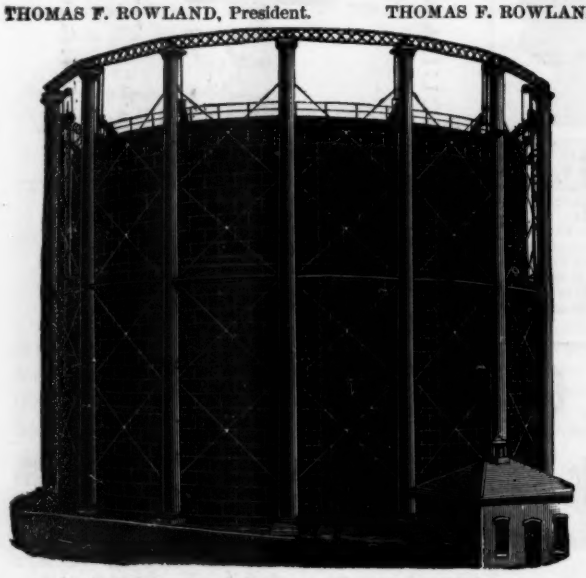
THE GOVERNMENT WATERPROOF PAINT.

Proof against Ammonia, and Absolutely Waterproof. Send for Prices and Particulars.

THE GOVERNMENT WATERPROOF PAINT CO., 104 High Street, Boston, Mass.

The Continental Iron Works

THOMAS F. ROWLAND, President. THOMAS F. ROWLAND, JR., Secretary & Treasurer. WARREN E. HILL and CHAS. H. CORBETT, Vice-Presidents.



BROOKLYN, N. Y.

TAKE EAST TENTH OR TWENTY-THIRD STREET FERRIES FROM NEW YORK TO GREENPOINT.

BUILDERS OF

GAS HOLDERS.

Single and Multiple Section Gas Holders a Specialty.

Wrought Iron Gas Holder Tanks.

BENCH CASTINGS, RETORT LIDS.

Hydraulic Mains, Condensers, Scrubbers, Purifiers, Valves, Etc., Etc.

SELF-SEALING RETORT MOUTHPIECES & LIDS.

For Round, Oval, or "D" Retorts.

Reliable Gas Heaters, Parlor Grates and Radiators.

Three Distinct Lines.

Sixty Different Styles.

Ranging in Price from

$5.00 to $30.00.

Send for 1894 Catalogue of Heating Stoves.

New Designs and

Improvements for 1894.

The Largest and Most Complete Line ever Manufactured Under one Name.

The SCHNEIDER & TRENKAMP CO.,

Sole Manufacturers of Reliable Gas Heaters.

479-501 Case Ave., Cleveland, Ohio.

Jewel Gas Heating Stoves
For 1893-94.

Send for Catalog of the Most Artistic Line of Heaters on the Market.

The New Double Reflector is Worthy of Attention.

22 Styles. Prices from $4.50 to $12.

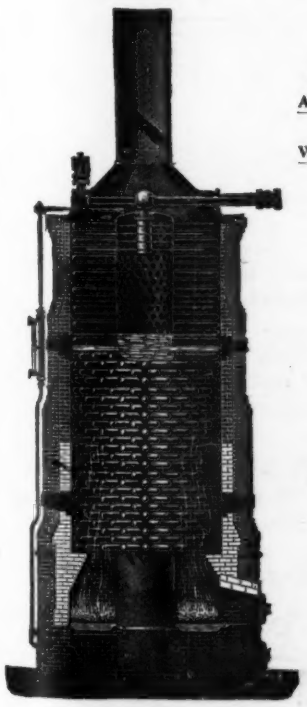
GEORGE M. CLARK & COMPANY,

MAKERS,

149-161 Superior St., Chicago

The HAZELTON BOILER Frequently Called The PORCUPINE BOILER

Patented in America and Abroad.



100,000 HORSE POWER

of this Justly Celebrated Water-Tube Boiler in Successful Operation in all the Principal Industries.
An Unparalelled Record, of Over Twelve Years, for Economy, Durability, Safety, and Efficiency.
A Common-Sense High-Pressure Boiler made in a Superior Manner.
We Solicit for it the Critical Examination of the Mechanical Profession and the Steam-Using Public.

THE HIGHEST STANDARD OF EXCELLENCE.

Standard Sizes, 50 H.P. to 500 H.P.

THREE REGISTERED
THE HAZELTON BOILER.

THE PORCUPINE BOILER.
TRADE MARKS.

Special Sectional Boilers For Export.

The only Genuine Hazelton or Porcupine Boilers bear our Three Registered Trade Marks.

∴ BEWARE OF IMITATIONS. ∴

This Company is prepared to Manufacture and Furnish Plants of Boilers of any desired capacity, and will forward proposals and other information on application. All imitations of the substantial features of this Boiler are infringements, and will be prosecuted to the full extent of the law.

THE HAZELTON BOILER CO.,

Sole Proprietors and Manufacturers, NEW YORK, U. S. A.

Cable Address, "PAILA," NEW YORK.

WRITE FOR ILLUSTRATED CATALOGUE. Correspondence Solicited.

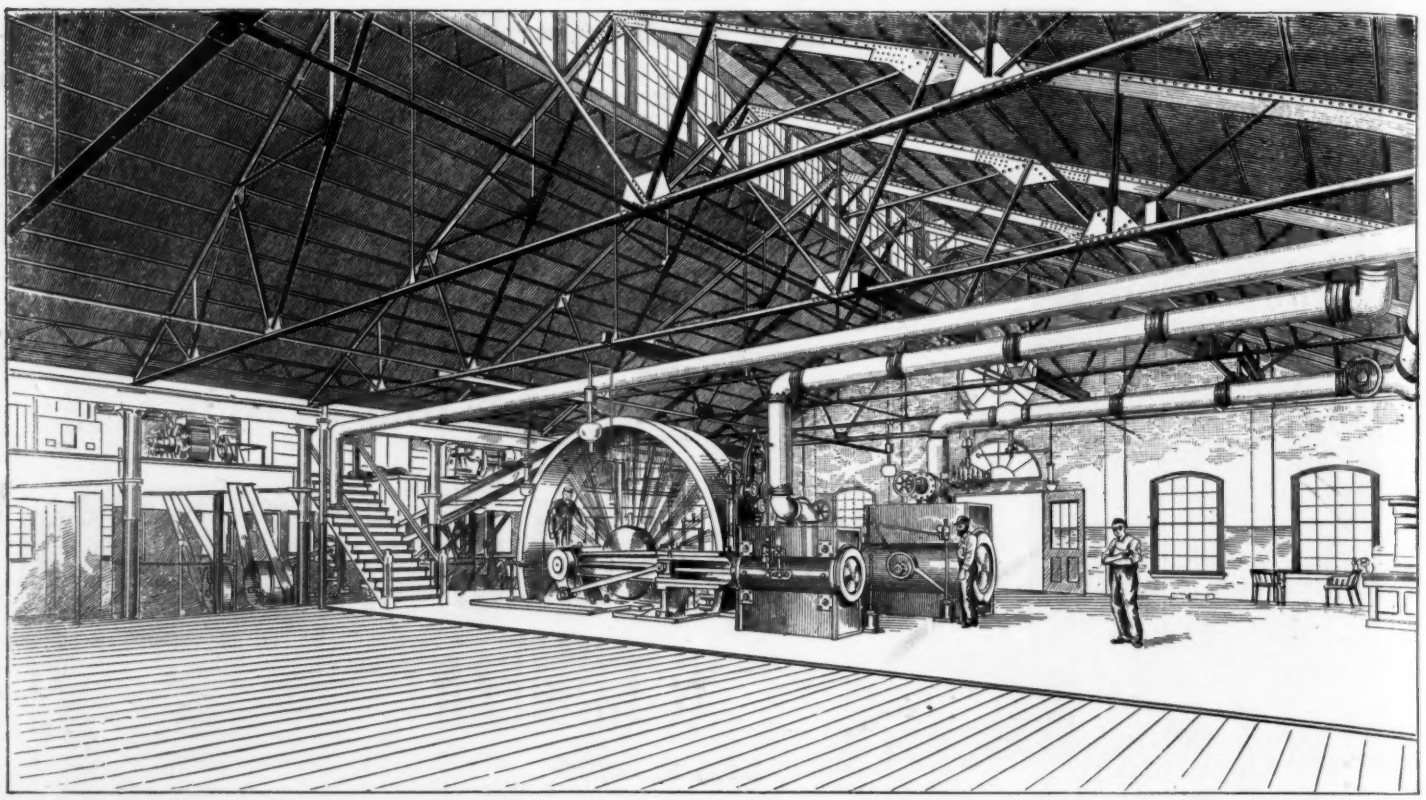
Long Distance Telephone, 1229-18th St., New York.

This Boiler is producing unequaled results in the works of most of the principal Gas Co.'s of the U.S., and in similar plants in Foreign Countries

NOT CONNECTED WITH ANY OTHER CONCERN IN THE UNITED STATES

CHAS. M. JARVIS, Prest. & Chief Engineer. BURR K. FIELD, Vice-President. FRANK L. WILCOX. Treasurer. GEO. H. SAGE, Secretary.

THE BERLIN IRON BRIDGE CO.



The above illustration is taken direct from a photograph, and shows an Iron Truss Roof designed and built by us for the Engine Room of the Pawtucket Gas Co., at Pawtucket, R. I. The roof trusses are of iron, with iron purlins covered with our Patent Anti-Condensation Corrugated Iron Roofing. This roofing is guaranteed not to drip in the coldest winter weather, and is the only known method of preventing drip from corrugated iron in cold weather.

Write for Illustrated Catalogue.

Office and Works, No. 6 Railroad Avenue, East Berlin, Conn.

HIGH CANDLE POWER

FROM

GAS.

MR. WALTON CLARK, Assistant General Superintendent, United Gas Improvement Co.:

Dear Sir—In accordance with your request, I have made several ests of the new Welsbach mantel (called No. 169) for candle power and efficiency, and I herewith submit the following results:

	Candle Power.	Pressure.	Gas Consumed.	C.P. per Cu. Ft.
Average of Test No. 1,	67.05	.95 in.	2.6	25.70
" " No. 2,	63.86	1.00 in.	2.86	22.30
" " No. 3,	72.50	2.1 in.	2.87	25.26

The above averages are the results of trials on three different occasions, and in each case the mantles tested were made from a different lot of fluid.

The mantles used in the above tests were selected at random, and all had been dipped in kristaline and dried ready for shipment.

It is quite possible that better results could have been obtained by manipulating and readjusting the position of the mantles on the galleries, and also by waiting a longer period after burning off the kristaline; but I considered such fine adjustment undesirable in determining the commercial candle power.

These tests were made on a bar photometer against a regular Edgerton standard slit. The candle power of the slit was 6.18, and the gas used was Gloucester City water gas, 26 candle power.

Very truly yours,
(Signed) C. H. PAGE, JR., M.E.

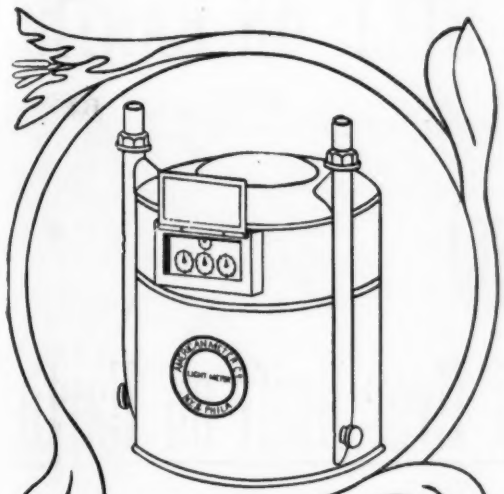
WE ARE NOW PREPARED TO FILL ALL ORDERS PROMPTLY FOR

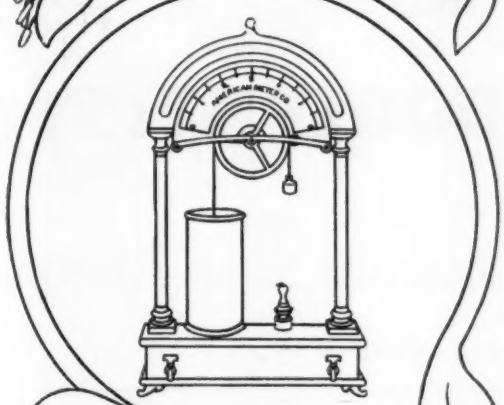
HIGH CANDLE POWER WELSBACH LIGHTS.

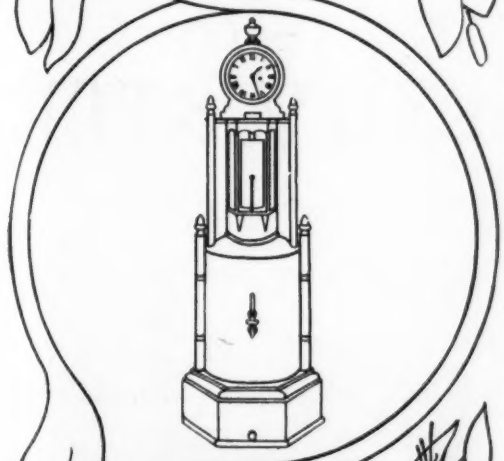
Gloucester, N. J. WELSBACH LIGHT CO.

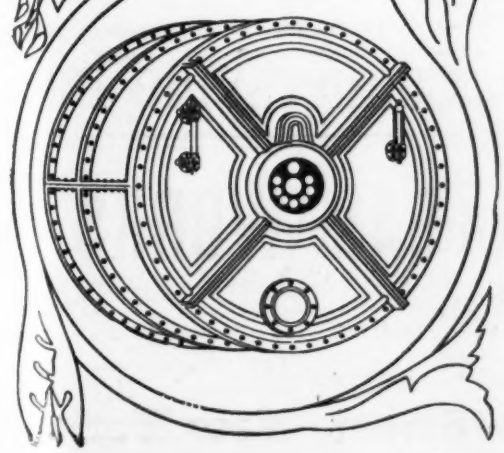
NEWBIGGING'S HANDBOOK FOR GAS ENGINEERS AND MANAGERS.

The present (the fifth) edition marks an important advance on those that have gone before. Considerable additions have been made to the text and much of it has been rewritten and otherwise improved. Price, cloth, $6. A. M. CALLENDER & CO., 32 Pine St. N. Y.









AMERICAN METER CO.

ESTABLISHED 1834. INCORPORATED 1863.

NEW YORK and PHILADELPHIA.

CHICAGO, CINCINNATI,

ST. LOUIS, SAN FRANCISCO.

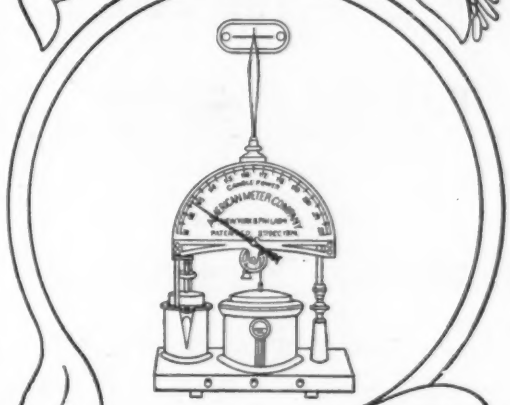
PUBLIC LIGHTING TABLE.

DECEMBER, 1893.

Day of Week.	Table No. 1. Following the Moon. Date.	Light.	Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Extinguish.
				P.M.	A.M.
Fri.	1	5.00 PM	2.30 AM	4.20	6.10
Sat.	2	5.00	3.30	4.20	6.10
Sun.	3	5.00	4.30	4.20	6.15
Mon.	4	5.00	5.40	4.20	6.15
Tue.	5	5.00	6.10	4.20	6.15
Wed.	6	5.00	6.10	4.20	6.15
Thu.	7	5.00	6.10	4.20	6.15
Fri.	8	5.00 NM	6.10	4.20	6.15
Sat.	9	5.00	6.10	4.20	6.15
Sun.	10	5.00	6.10	4.20	6.20
Mon.	11	5.00	6.10	4.20	6.20
Tue.	12	5.00	6.10	4.20	6.20
Wed.	13	8.30	6.10	4.20	6.20
Thu.	14	9.30	6.10	4.20	6.20
Fri.	15	10.30	6.20	4.20	6.20
Sat.	16	11.30 FQ	6.20	4.20	6.20
Sun.	17	12.50 AM	6.20	4.20	6.20
Mon.	18	2.00	6.20	4.20	6.20
Tue.	19	3 20	6.20	4 20	6.20
Wed.	20	4.20	6.20	4.20	6.20
Thu.	21	No L	No L.	4.20	6.20
Fri.	22	No L FM	No L.	4.20	6.20
Sat.	23	No L	No L.	4.20	6.20
Sun.	24	5.10	7.20 PM	4.20	6.25
Mon.	25	5.10	8.40	4.20	6.25
Tue.	26	5.10	10.00	4.20	6.25
Wed.	27	5.10	11.10	4.20	6.25
Thu.	28	5.10	12.20 AM	4.20	6.25
Fri.	29	5.10 LQ	1.20	4.20	6.25
Sat.	30	5.10	2.30	4.20	6.25
Sun.	31	5.10	3.30	4.20	6.25

TOTAL HOURS LIGHTING DURING 1893.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January...	217.30	January...	423.20
February..	200.30	February..	355.25
March	177.50	March	355.35
April.....	160.30	April.....	298.50
May.....	149.00	May.....	264.50
June.	140.30	June.....	234.25
July	143.40	July.....	243.45
August....	154.50	August....	280.25
September.	171.50	September.	321.15
October....	202.20	October....	374.30
November.	221.30	November.	401.40
December.	248.50	December.	433.45
Total..	2188.50	Total..	3987.45



THE GREATEST EXPOSITION EVER HELD ON EARTH

HAS AWARDED A MEDAL AND DIPLOMA TO

THE GREATEST (the "Roots," of course)

ROTARY GAS EXHAUSTER Ever Built on Earth.

The Judges say it is the "Best," too.

P. H. & F. M. ROOTS COMPANY,

MANUFACTURERS,

Home Office, Connersville, Ind. **Branch Office, 501 Manhattan Building Chicago.**

S. S. TOWNSEND, Gen. Agt., COOKE & CO., Selling Agts., 163-165 Washington St., N. Y. City.

WE GUARANTEE

THE BEST DESIGNED, . .
THE BEST CONSTRUCTED,
THE SMOOTHEST RUNNING,
THE MOST ECONOMICAL, .
THE MOST EFFICIENT . .

GAS EXHAUSTER

NOW ON THE MARKET.

The attention of Gas Engineers and Manufacturers is respectfully invited to our new

CYCLOIDAL EXHAUSTER,

the internal operating parts of which consist of two Revolvers, each planed accurately on cycloidal lines, the only Exhauster so constructed.

SIMPLICITY * EFFICIENCY * DURABILITY.

Correspondence Solicited.

The CONNERSVILLE BLOWER CO., Connersville, Ind.

THE MANAGEMENT OF SMALL GAS WORKS.

By C. J. R. HUMPHREYS,

Price, $1.00.

A. M. CALLENDER & CO., No. 32 Pine Street, New York.

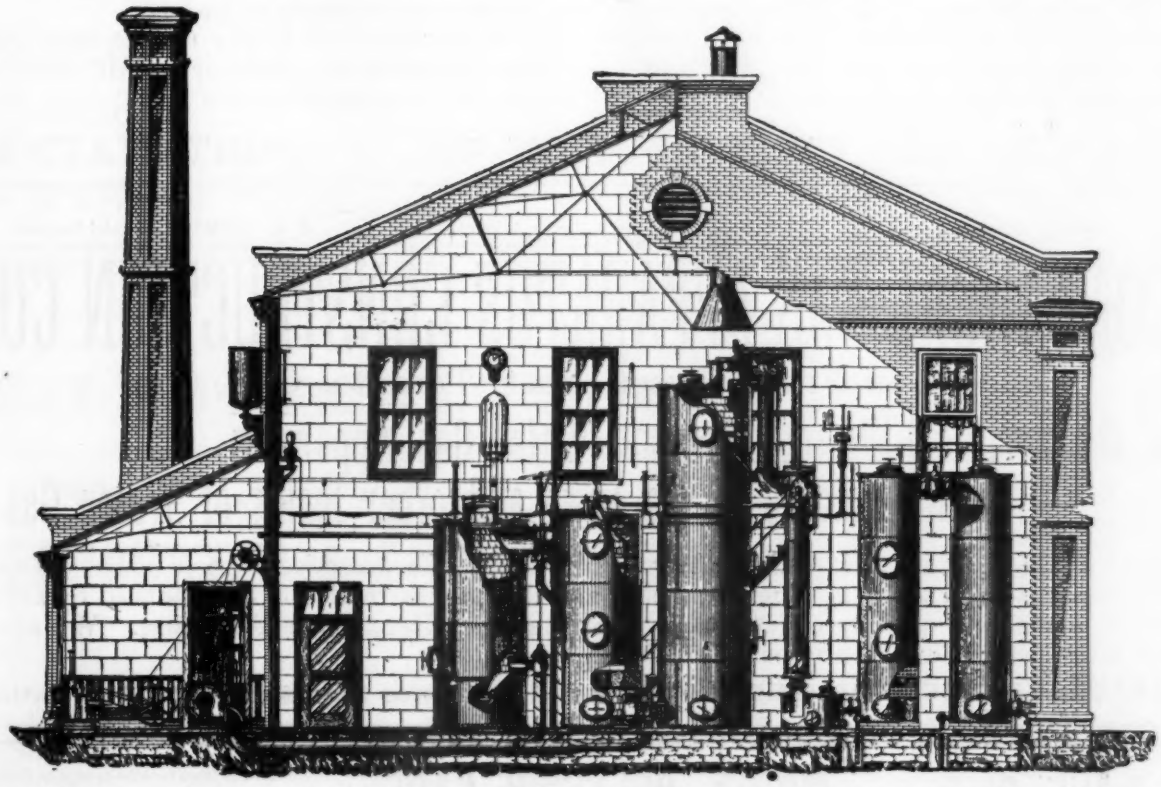
THE UNITED GAS IMPROVEMENT CO.,

DREXEL BUILDING, PHILA., PA.

Inquiries from any part of the United States should be addressed to the Philadelphia Office.

BUILDERS OF

THE STANDARD LOWE WATER GAS APPARATUS.



Standard "Double Superheater" Lowe Apparatus, designed for the use of Naphtha, Crude Oil, or "Distillates."

BUILDERS, LESSEES AND PURCHASERS OF GAS WORKS.

Water Gas Plants, either independent or auxiliary to Coal Gas Works, erected to meet any conditions. Apparatus designed to use any grade of Oil, and Anthracite Coal, or Gas House or Oven Coke.

PAMPHLETS, PLANS AND ESTIMATES FURNISHED UPON APPLICATION.

WATER GAS APPARATUS

BY THE

WESTERN GAS CONSTRUCTION CO.,

Of Fort Wayne, Ind.

The number of Water Gas Plants built by us this year fully testify to the merit of our **Improved** style of **Lowe Water Gas Apparatus.** Results obtained in the various sizes of our plants, up to over 900,000 cubic feet capacity per diem, show what can be attained in a well designed machine. We are prepared to **Guarantee Results,** as well as first-class construction. We build apparatus ranging in capacity from 50,000 cubic feet to 1,000,000 cubic feet per diem, and larger when required.

Our shop facilities are unexcelled, and enable us to quote prices which will prove interesting. The plants in operation demonstrate we have the **Experience** necessary to build Water Gas Apparatus on **Scientific** as well as **Practical** principles, and consequently **Build them Well.** Hence we don't hesitate to **Guarantee the Results.** We not only believe in "Water Gas on its merits," but also in building the apparatus at a price that will not only prove it a desirable investment as to the first cost, but produce results that will put the balance on the right side of your ledger.

There are three essential features in our design which we carefully considered as **Absolute Requirements:**

Durability, neatness, and compactness of the machine.

Minimum labor requirements for operation, and

Minimum amount of material required for results.

And when we add to this a minimum cost of a **Strictly First-Class Apparatus,** can you afford to be without it? If not, write us, and we shall take pleasure in proving our statements to be facts.

Also remember we are not exclusively building Water Gas Apparatus, but if you require **Any Apparatus** for **Coal or Water Gas** and want the latest and best designs, write us for prices, or we will execute carefully your own designs if desired, as we believe in giving you exactly what you want.

THE WESTERN GAS CONSTRUCTION CO., - FORT WAYNE, IND.

W. H. PEARSON, President. J. T. WESTCOTT, Gen'l Mang'r & Treas. (Formerly with The United Gas Improvement Co. L. L. MERRIFIELD, Chief Engineer. (Formerly with the United Gas Improvement Co.)

The ECONOMICAL GAS APPARATUS CONSTRUCTION CO., Ltd.

Office, 269 Front Street, East, Toronto, Ont., Can.

Owners of the Merrifield-Westcott-Pearson Water Gas Apparatus, and Builders of the Lowe and other forms of Water Gas Plants.

Our system includes a combination of the best processes of Water Gas manufacture now in use, and an apparatus of novel construction, which enables us to make a better and cheaper gas than can be produced by any other process. Guarantees given as to quantity of fuel and oil used, make per diem, and candle power. We also make an apparatus which is especially designed for small Gas Companies.

CORRESPONDENCE SOLICITED. **Plans and Estimates Furnished upon Application.**

E. G. LOVE, Ph.D.,

Analytical and Consulting Chemist.

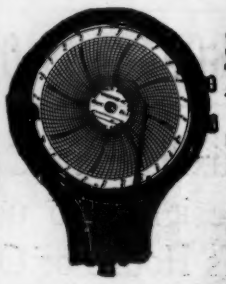
Analyses of Coals, Purifying Materials, Gas, Gas Liquor, Water, and all Technical Products. Photometric and Calorimetric Determinations.

122 Bowery, New York City.

BRISTOL'S RECORDING **PRESSURE GAUGE**

For Continuous Records of

Street Gas Pressure.



Simple in Construction,
Accurate in Operation,
Low in Price,
Fully Guaranteed.

Send for Circulars.

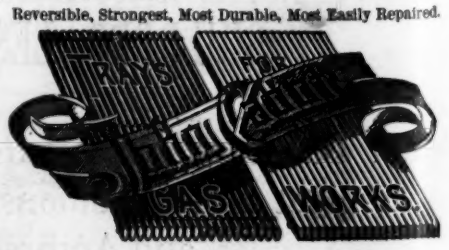
The BRISTOLS' MFG. CO.
Waterbury, Conn.

Received Medal at World's Columbian Exposition.

Special Trays for Iron Sponge or Oxide of Iron.

CHURCH'S TRAYS a Specialty.

Reversible, Strongest, Most Durable, Most Easily Repaired.



306-310 Eleventh Avenue, New York.

We also make the Cheapest and Strongest REVERSIBLE BOLTED TRAYS IN THE MARKET.

Send for Circulars.

NATIONAL GAS AND WATER CO.,

218 La Salle St., Chicago, Ill.

HENRY C. REW, Prest. C. D. HAUK, Vice-Prest. & Mang'r. N. A. McCLARY, Sec'y. IRWIN REW, Treas. E. E. MORRELL, Engineer.

Builders and Operators of Gas Works.

WATER GAS APPARATUS A SPECIALTY.

SOLE OWNERS OF THE REW SOFT COAL CARBURETED WATER GAS APPARATUS.

Guaranteed Estimates of Cost of Gas in Holder Furnished upon Application.

CONNELLY IRON SPONGE AND GOVERNOR CO.,

(Successors to CONNELLY & CO.)

MANUFACTURERS OF GAS WORKS SPECIALTIES.

"IRON SPONGE." Saves money, saves labor, and is the most efficient purifying material ever offered as a substitute for lime. We guarantee a large saving, both in cost of material and labor.

AUTOMATIC GOVERNOR. OVER FOUR HUNDRED NOW IN USE! NO WORKS COMPLETE WITHOUT IT! WILL PAY FOR ITSELF WITHIN A YEAR! ITS SERVICE SECURES PERFECT DISTRIBUTION! REDUCES LEAKAGE TO MINIMUM, and BENEFITS THE COMPANY and CONSUMER ALIKE! IT IS THE ONLY RECOGNIZED AUTOMATIC GOVERNOR IN THE WORLD!

STEAM JET EXHAUSTER. Designed particularly for small works. Combines Exhaust Tube, Steam Governor, Gas Compensator and Bye-Pass Valves in the most compact form possible. Occupies but little space; uses very little steam; saves formation of carbon in retorts; increases yield 10 to 15 per cent. No works too small to use them profitably.

Prices given on all our specialties, delivered at any point in the United States. Correspondence solicited.

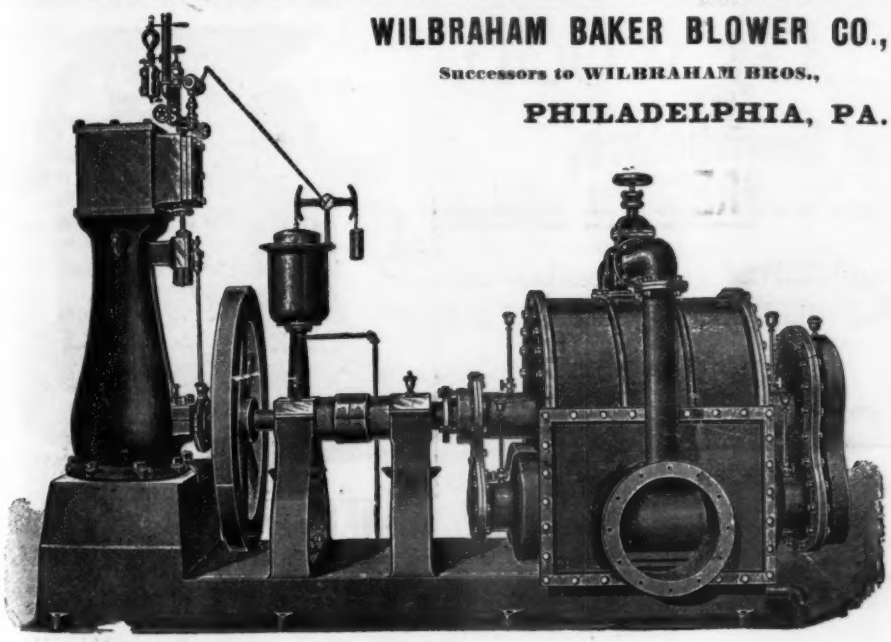
CONNELLY IRON SPONGE AND GOVERNOR CO., No. 365 Canal St., New York.

WILBRAHAM
GAS EXHAUSTER & ENGINE COMBINED.

WILBRAHAM BAKER BLOWER CO.,

Successors to WILBRAHAM BROS.,

PHILADELPHIA, PA.



IRON MASS

For Gas Purification.

Acts immediately, and more efficiently than any other purifying agent now in use.

Greenpoint Chemical Works.

JOHN SCHRIEVER, Manager.

Greenpoint Ave. & Newtown Creek, Brooklyn N.Y.

DOUGLAS' FERRIC OXIDE

For Gas Purification

Is a superior natural Hydrated Oxide of Iron. Will give a higher purification per bushel than any other material. We ship the pure Oxide of Iron, containing no sawdust, thus effecting a saving in freight, leaving the consumer to furnish the diluent at a nominal cost. It is now used by the largest gas companies in the West.

Full information, with references to many users, and prices delivered in any locality, furnished on application to

H.W. Douglas (Supt. Ann Arbor Gas Company) **Ann Arbor, Mich.**

GAS COALS. CANNEL COALS. COKE CRUSHERS.

JAMES D. PERKINS. **PERKINS & CO.,** F. SEAVERNS.

228 & 229 Produce Exchange, New York.

Cable Address, "PERKINS, NEW YORK." Post Office Box 3695, New York.

GENERAL SALES AGENTS FOR

The Youghiogheny River Coal Company's

OCEAN MINE YOUGHIOGHENY GAS COAL.

This Colliery is located at Scott Haven, Pa., in the center of the Youghiogheny Gas Coal District, and produces the only reliable Youghiogheny Coal for gas purposes. (See Map on p. 87 of this JOURNAL, Feb. 16, '85.)

Shipment from LOCUST POINT, BALTIMORE.

ALSO, SOLE SHIPPERS OF THE

Old Kentucky Shale, From Kentucky.

TRADE O. K. SHALE. MARK.

THE MOST VALUABLE GAS ENRICHER NOW AVAILABLE IN ANY DESIRED QUANTITY.

S. CALVERT FORD, Government Inspector at Washington, pronounces this Shale

"ONE OF THE BEST GAS ENRICHERS THAT HAS BEEN OFFERED TO THE TRADE."

He reports it as giving:

12,553 Cubic Feet of 50-Candle Gas,
or 10,460 Cubic Feet of 60-Candle Gas,

AN EQUIVALENT OF 627,650 CANDLE FEET,

And 808 Pounds of Merchantable Coke.

Single Carloads or more delivered at any required point in the United States or Canada.

Cargo Shipments from NEW YORK, PHILA., BALTIMORE and NEWPORT NEWS.

JAMES & WILLIAM WOOD,

Gas and Cannel Coal Contractors,

No. 40 St. Enoch Sq., Glasgow. No. 2 Talbot Court, London.

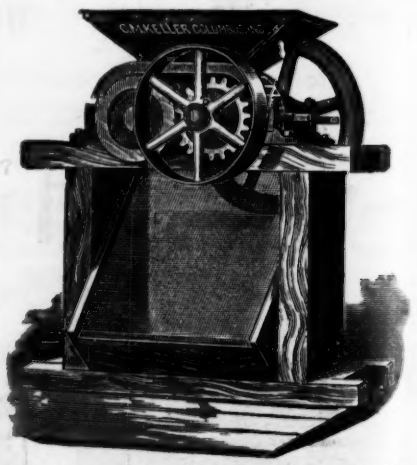
Proprietors of the **BATHVILLE COLLIERIES** (which produce the celebrated **BOGHEAD CANNEL**), Shields, Shieldmuir, Drumpeller, and other Collieries. This Firm offer

STANDARD CANNELS,

Unequaled as Gas Enrichers.

Analyses, prices, and all further information furnished on application to

Agency for United States 52 William Street, N. Y. City.



Keller's Adjustable Coke Crusher

SIMPLE, STRONG, AND DURABLE.

J. M. Keller, Sec. & Supt. Gas Lt. & Coke Co. Columbus, Ind.

Correspondence Solicited.

GAS ENRICHERS.

The Despard Gas Coal Co.,

MINERS AND SHIPPERS OF

DESPARD GAS COAL,

AND MANUFACTURERS OF

COKE.

MINES, Clarksburg, Harrison Co., W. Va.
WHARVES, Locust Point, Baltimore, Md.
OFFICE, 44 South Street, Baltimore, Md

ROUSSEL & HICKS, 71 Broadway, N. Y. } AGENTS. { BANGS & HORTON, 60 Congress St., Boston

Westmoreland Vein and West Va. Gas Coals.

BRECKENRIDGE AND LEXINGTON CANNELS.

HENRY C. SCHEEL, General Sales Agt.,

P. O. Box 2228. No. 1 Broadway, N. Y.

JOS. R. THOMAS,

No. 32 Pine Street, N.Y. City.

CONSULTING AND CONSTRUCTING

Gas Engineer and Contractor.

PLANS, SPECIFICATIONS, AND ESTIMATES FURNISHED.

Contracts taken for all Appliances required at a Gas Works,

Either for New Works or Extensions to Old Plants.

H. C. SLANEY,

Gas Engineer

466 Sixth Street, Brooklyn, N. Y.

Plans, Specifications and Estimates furnished for New Works, Alteration or Extension of Old Plants.

GEORGE R. ROWLAND,

Formerly with the Continental Iron Works.

Draughtsman and Constructing Engineer.

Drawings, Specifications and Estimates furnished for the construction of new works or alteration of old works. Special attention given to Patent Office drawings.

Office, No. 245 Broadway, N. Y. City.

JAMES R. SMEDBERG,

Gas Engineer and Architect,

Room 638, Rialto Building,
CHICAGO, ILL.

GAS COALS. GAS COALS.

THE PENN GAS COAL CO.

OFFER THEIR

Coal, Carefully Screened & Prepared for Gas Purposes.

Their Property is located in the Youghiogheny Coal Basin, near Irwin and Penn Stations on the Pennsylvania Railroad, and on the Youghiogheny River.

Principal Office:

209 SOUTH THIRD STREET, PHILA., PA.

Points of Shipment:

Pennsylvania Railroad Piers; Greenwich Wharves, Delaware River; Pier No. 1 (Lower Side), South Amboy, N. J.

Chesapeake & Ohio Railway Coal Agency,

FOR THE SALE OF THE

Superior Kanawha Gas Coals, Cannelton Cannel,

Also, SPLINT AND STEAM COALS,

From the Kanawha and New River Regions, on the line of the Chesapeake & Ohio R'way.

C. B. ORCUTT, General Agent, - - No. 1 Broadway (Room 217) New York City

EDMUND H. McCULLOUGH, Prest. CHAS. F. GODSHALL, Treas. H. C. ADAMS, Sec.

THE WESTMORELAND COAL CO.

Chartered 1854.

Mines situated on the Pennsylvania and the Baltimore and Ohio Railroads, in Westmoreland County, Pa.

POINTS OF SHIPMENT:

PHILADELPHIA, BALTIMORE, SOUTH AMBOY, N. J.,
WATKINS (SENACA LAKE), N. Y.

Since the commencement of operations by this Company its well-known Coal has been largely used by the Gas Companies of New England and the Middle States, and its character is established as having no superior in gas-giving qualities, and in freedom from sulphur and other impurities.

Principal Office, 224 South 3d St., Phila., Pa.

Standard Oil Company,

GAS NAPTHA DEPARTMENT.

GAS NAPTHA.

GAS OIL.

26 Broadway, New York City.

Correspondence Solicited

RETORTS AND FIRE BRICK. RETORTS AND FIRE BRICK. RETORTS AND FIRE BRICK.

J. H. GAUTIER & COMPANY
CORNER OF
GREENE AND ESSEX STREETS,
JERSEY CITY, N. J.
MANUFACTURERS OF
Clay Gas Retorts,
Gas House Tiles,
Fire Bricks, Etc. Etc.
Ground Clay, Fire Brick and Fire Sand in Barrels,
J. H GAUTIER, Prest. CHAS. E. GAUTIER, Sec. & Treas.
CHA . E. GREGORY, V.-Prest. DAVID R. DALY Gen'l Mang'r.

Brooklyn Fire Brick Works,
MANUFACTURERS OF
CLAY RETORTS, FIRE BRICK,
Gas House and other Tile.
Office, 88 Van Dyke St., Brooklyn, N. Y.

LACLEDE FIRE BRICK MFG. CO.,
MANUFACTURERS OF
Fire Brick, Gas Retorts,
AND
ST. LOUIS STANDARD SEWER PIPE.
Blast Furnace and Cupola Linings, every description of Fire Clay Material, Fire Clay Flue Linings, Chimney Tops Dry Milled and Crude Fire Clays, etc.
OFFICE AND DEPOT
901, 903, and 905 Pine Street,
ST. LOUIS, MO.

ESTABLISHED IN 1845.
B. KREISCHER & SONS,
OFFICE FOOT OF HOUSTON ST., E.R., N.Y.
Gas Retorts,
TILES, FIRE BRICK.
AND EVERYTHING IN THE FIRE CLAY LINE.

MANHATTAN
FIRE BRICK & ENAMELLED CLAY
RETORT WORKS
ADAM WEBER.
CLAY GAS RETORTS
AND RETORT SETTINGS
FIRE BRICKS, TILES, ETC.,
Office and Works, 15th Street and Avenue C., N. Y

CYRUS BORGNER, Successor to
BORGNER & O'BRIEN
29th ST. ABOVE RACE PHILADA. PA. U.S.A.
FIRE BRICK AND CLAY RETORTS

Works,
LOCKPORT STATION, PA.
—ESTABLISHED 1864.—
JAMES GARDNER, JR.,
Successor to WILLIAM GARDNER & SON.
Office, Rooms 19 & 20, Lewis Block
PITTSBURGH, PA. P. O. Box 373
Fire Clay Goods for Gas Works.
SOLE REPRESENTATIVE OF THE McILHENNY REGENERATIVE BENCHES FOR THE U. S.
H. A. NORTON, No. 92 WATER STREET, BOSTON, MASS., Agent for the New England States.

HENRY MAURER & SON,
(ESTABLISHED 1856.)
EXCELSIOR FIRE BRICK & CLAY
RETORT WORKS
WORKS, Perth Amboy, N. J.
OFFICE, 418 to 422 East 23d St., N. Y.
Clay Gas Retorts,
BENCH SETTINGS,
Fire Brick, Tiles, Etc.

GEROULD'S IMPROVED RETORT CEMENT.
A cement of great value for patching retorts, putting on mouthpieces, making up all bench-work joints, lining blast furnaces and cupolas. This cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick.
PRICE LIST.
In Casks, 600 to 800 lbs., f.o.b. N. Y., at 5 cents per pound.
In Kegs, 100 to 300 lbs., " " at 6 " "
In Kegs less than 100 lbs., " " at 7 " "
C. L. GEROULD & CO.,
5 & 7 Skillman St., Brooklyn, N. Y.
Western Agent, H. T. GEROULD, Decatur, Ills.

Parker-Russell Mining and Mfg. Co.,
CITY OFFICE,
Mermod-Jaccard Bldg., Rooms 307 & 308,
Broadway & Locust St., St. Louis. Mo.
PROPRIETORS OF THE
OAKHILL GAS RETORT & FIRE BRICK W'KS
Our immense establishment is now employed almost entirely in the manufacture of
Materials for Gas Companies
We have studied and perfected three important points. Our retorts are made to stand changes of temperature, the strongest heats of the furnace, and the abrasion of feeding and emptying. We have the *exclusive Agency for the West* of the celebrated
Kloenne-Bredel Full Depth and Semi-Recuperator Benches,
And also furnish and build
Our Own Styles Semi-Recuperator Furnaces for the use of Coal or Coke as fuel.

THOS. SMITH, Prest. AUGUST LAMBLA, Vice-Prest. & Supt.
BALTIMORE
RETORT & FIRE BRICK CO.
MANUFACTORY AT
LOCUST POINT BALTIMORE MD.
Clay Retorts, Blocks & Tiles
FIRE BRICK, FIRE CLAY,
AND FIRE CEMENT.
Red and Buff Ornamental Tiles and Chimney Tops. Drain and Sewer Pipe (from 2 to 30 inches). Baker Oven Tiles 12x12x2 and 10x10x2.
WALDO BROS., 88 WATER ST., BOSTON, MASS
Sole Agents the New England States.

King's Treatise on Coal Gas.
In Three Volumes. Price per Vol., $10.
Sold either by Volume or in Sets.
Standard text-book for the Engineers and Managers of Gas Works, and for all who are concerned or take an interest in the manufacture and distribution of Coal Gas, and in the utilization of the Secondary Products resulting therefrom; treating also of the Gas Engine and of Gas Cooking and Heating Appliances.
WM. M. CALLENDER & CO., 32 Pine Street, N. Y. City

FRED. BREDEL, C. E.,

PROP'R OF KLOENNE AND BREDEL PATENTS.

Recuperative Furnaces, Purifying Machines,

* Gas Apparatus. *

Main Office, 118 Farwell Avenue, Milwaukee, Wis.

New York Office, 22 Beaver Street.

Gasholder Tanks & Gas Works Masonry Complete.

PLANS PREPARED AND ESTIMATES FURNISHED AT SHORT NOTICE.

J. P. WHITTIER, 70 Rush St., near Division Av., Brooklyn, N. Y.

A Large Quantity of Ground Fire Brick For Sale Cheap.

1893 DIRECTORY 1893

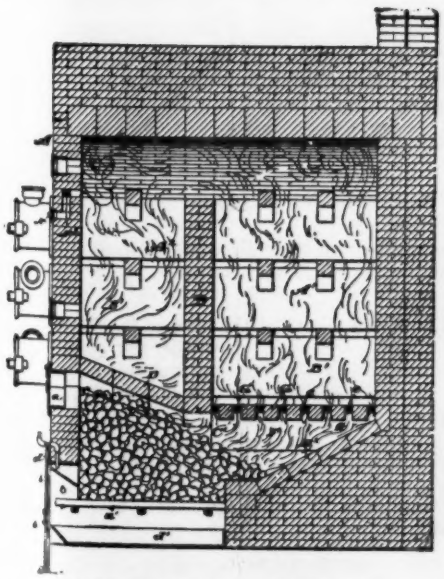
OF AMERICAN GAS COMPANIES.

Price, - - - - - - - - - $5.00.

A. M. CALLENDER & CO., - - No. 32 Pine Street, New York.

FLEMMING'S

Generator-Gas Furnace



Materials furnished and Benches erected by

J. H. GAUTIER & CO., - Jersey City, N. J.

Address as above, or D. D. FLEMMING, Jersey City, N. J.

AMERICAN GAS LIGHT JOURNAL.

$3.00 per Annum.

A. M. CALLENDER & CO.
32 Pine Street, N. Y

The Miner Street Lamps.

Jacob G. Miner,

No. 823 Eagle Ave., New York, N. Y.

Bartlett Street Lamp Mfg. Co.

MANUFACTURERS OF

Globe Lamps,

FOR

Streets, Parks, Public Buildings, Railroad Stations, etc.

LAMP POSTS

A Specialty.

Office and Salesroom,

40 & 42 COLLEGE PLACE, - - N. Y. CITY

Gas Companies and others intending to erect Lamp and Posts will do well to communicate with us.

Parson's Steam Blower,

FOR IMPROVING BAD DRAUGHT IN BOILERS, AND FOR BURNING BREEZE OR OTHER WASTE MATERIAL.

PARSON'S TAR BURNER,

FOR UTILIZING COAL TAR AS FUEL.

PARSON'S AIR JET TUBE CLEANER,

FOR CLEANING BOILER TUBES.

These devices are all first-class. They will be sent to any responsible party *for trial.* No sa unless satisfactory. Manufactured by the WATERTOWN STEAM BLOWER COMPANY.

H. E. PARSON. Supt., No. 54 Pine St., N. Y.

DAVIS & FARNUM MFG. CO.

WALTHAM, MASS.

PRINCIPAL OFFICE AND WORKS, WALTHAM, MASS. BOSTON OFFICE, Room 18, Vulcan Building, 8 Oliver Street.

Single, Double and Triple-Lift

GASHOLDERS

of any Capacity.

Tubular, Pipe and Sinuous Friction

CONDENSERS

of all Sizes.

STEEL TANKS for GASHOLDERS. IRON ROOF FRAMES and FLOORS.

Purifying Boxes, Center Seal or Valve Connections, Bench Work.

Reversible Lime Trays.

SELF-SEALING AND PRESSED STEEL MOUTHPIECE LIDS.

Coke Barrows, Coal Wagons, and all Apparatus Requisite for a Complete Gas Plant.

— ALSO —

GAS AND WATER PIPE, FLANGED PIPE,

Sugar House Work, and Special Castings of all Description.

This space belongs to the

KERR MURRAY MANUFACTURING COMPANY

All communications addressed to them at

Fort Wayne, Ind.

will receive prompt attention.

BARTLETT, HAYWARD & CO.

Baltimore. Md.

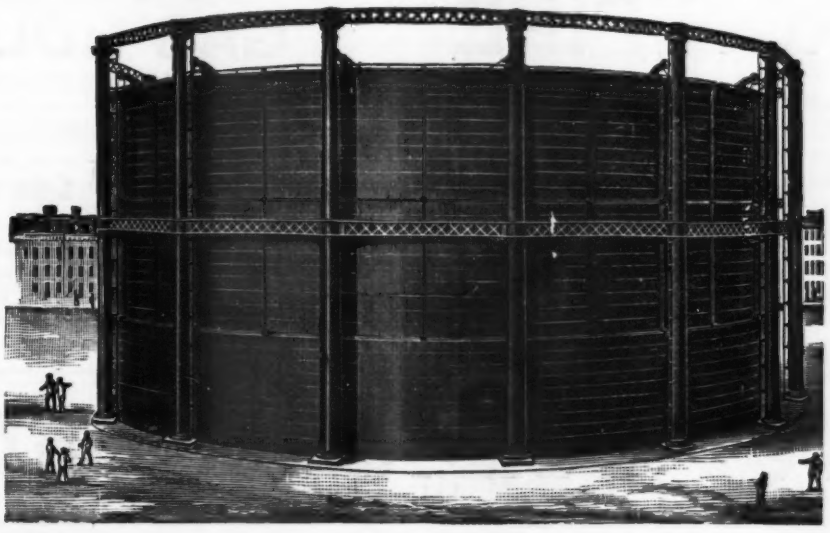
Triple Double, & Single-Lift
GASHOLDERS.

Iron Holder Tanks.

ROOF FRAMES.

Girders.

BEAMS.



PURIFIERS.

CONDENSERS

Scrubbers.

BENCH CASTINGS

OIL STORAGE TANKS.

Boilers.

The Wilkinson Water Gas Process.

THIRTY-CANDLE, NON-CONDENSABLE, FIXED GAS. THE MOST SUCCESSFUL GAS PROCESS IN OPERATION.

Munich Regenerative Furnace, System Drs. Schilling & Bunte.

MILL'S REVERSIBLE LIME TRAYS.

Gas Works Designed and Constructed.

SCIENTIFIC BOOKS.

ING'S TREATISE ON THE MANUFACTURE OF COAL GAS. Three vols.; $10 per vol.

GAS MANUFACTURE, by WILLIAM RICHARDS. 4to., with numerous Engravings and Plates, in Cloth binding. $12.

TECHNICAL GAS ANALYSIS. $3.

GAS CONSUMER'S GUIDE. $1.

GAS CONSUMER'S HANDBOOK, by WILLIAM RICHARDS, C.E.; 18mo., Sewed. 20 cents.

A PRACTICAL TREATISE ON GAS AND VENTILATION with Special Relation to Illuminating, Heating, and Cooking by Gas, by E. E. PERKINS. $1.25.

CHEMISTRY OF ILLUMINATING GAS, by NORTON H. HUMPHRYS. $2.40.

PRACTICAL TREATISE ON HEAT, by THOMAS BOX. Second edition. $5.

STRAINS IN IRONWORK, by H. ADAMS. With plates. $1.75

GAS WORKS—THEIR ARRANGEMENT, CONSTRUCTION, PLANT, AND MACHINERY. $8.

COAL; ITS HISTORY AND USE, by PROF. THORPE. $3.50.

THE GAS WORKS OF LONDON, by COLBURN. 60 cents.

HEAT A MODE OF MOTION, by JOHN TYNDALL. $2.50.

MUNICIPAL LIGHTING, by F. H. WHIPPLE. $1.

THE MANAGEMENT OF SMALL GAS WORKS, by C. J. R. HUMPHREYS. $1.

MANUAL FOR GAS ENGINEERING STUDENTS, by D. LEE, 40 cents.

THEORY OF HEAT, by J. CLERK-MAXWELL. $1.25.

AMMONIA AND AMMONIUM COMPOUNDS, by DR. R. ARNOLD. $2.

THE DOMESTIC USES OF COAL GAS, AS APPLIED TO LIGHTING, by W. SUGG. $1.40.

DIGEST OF GAS LAW. $5.

DISTILLATION OF COAL TAR AND AMMONIACAL LIQUOR, by GEO. LUNGE. New Edition. $12.50.

A TREATISE ON THE COMPARATIVE COMMERCIAL VALUES OF GAS COALS AND CANNELS, by D. A. GRAHAM 8vo., Cloth. $3.

GAS COMPANIES DIRECTORY, 1892. $5.

THE AMERICAN GAS ENGINEER AND SUPERINTENDENT'S HANDBOOK, by WM. MOONEY. $3.

GAS ENGINE INDICATOR DIAGRAM, by W. E. AYRTON. Paper. 20 cents.

ILLUMINATING AND HEATING GAS, by W. BURNS. $1.50.

HANDBOOK FOR MECHANICAL ENGINEERS, by HENRY ADAMS. $2.50.

NEWBIGGING'S HANDBOOK FOR GAS ENGINEERS AND MANAGERS, by THOS. NEWBIGGING. Fifth edition. $6.

A TREATISE ON MASONRY CONSTRUCTION. BARKER. $5

FUEL AND ITS APPLICATIONS. $7.50.

ELECTRICITY.

THE ELEMENTS OF ELECTRIC LIGHTING, Including Electric Generation, Measurement, Storage, and Distribution, by PHILIP ATKINSON. $1.50.

ELEMENTARY ELECTRICITY, by PROF. F. JENKIN. 40 cts

ELECTRIC TRANSMISSION OF ENERGY, by G. KNAPP. $3

ARC AND GLOW LAMPS, by J. MAIER. Illustrated. $3.

ELECTRICIAN'S POCKET-BOOK, by MONROE and JAMIESON $2.50.

MAGNETISM AND ELECTRICITY, by J. OVEREND. 40 cents

ACCUMULATORS, by SIR D. SALOMONS. $1.20.

DYNAMO BUILDING, by F. W. WALKER. 80 cents.

ELECTRICAL TABLES AND FORMULÆ, by L. CLARK R. SABINE. $5.

ELECTRIC LIGHTING FROM CENTRAL STATIONS, by G FORBES. Paper. 40 cents.

ELECTRIC LIGHT PRECAUTIONS, by K. HEDGES. Illustrated. $1.

DOMESTIC ELECTRICITY FOR AMATEURS, by E. HOSPITALIER. $3.

The above will be forwarded by express, upon receipt of price. If sent by mail, postage must be added to above prices. We take especial pains in securing and forwarding any other Works that may be desired, upon receipt of order. All remittances should be made by check, draft, or post office money order.

A. M. CALLENDER & CO., 32 Pine Street, New York

Foundries and Works: { Millville, N. J. / Florence, " / Camden, "

R. D. WOOD & CO.

ENGINEERS, IRON FOUNDERS, MACHINISTS

400 Chestnut Street, PHILADELPHIA, PA.

MANUFACTURERS OF

CAST IRON PIPE

SOLE MAKERS OF

THE MITCHELL SCRUBBER

(PATENTED)

PURIFIERS, CONDENSERS, SCRUBBERS.

THE HOPPER AUTOMATIC GAS GOVERNOR.
BENCH WORK. PLATE GIRDERS.
IRON FLOORS AND ROOFS.

BUILDERS OF

GAS HOLDERS

Single, Double and Triple Lifts, with or without Wrought Iron or Steel Tanks.

PEASE'S PATENT WIRE ROPE GUIDING FOR GAS HOLDERS.

CUTLER'S
PATENT FREEZING PREVENTER
FOR GAS HOLDER CUPS.

THE TAYLOR REVOLVING BOTTOM GAS PRODUCER,
HEAVY LOAM CASTINGS, DUNHAM SPECIALS, HYDRAULIC WORK
LAMP POSTS, VALVES, ETC.

Coal Tar Genealogical Tree

MR. T. VINER CLARKE, of London, Eng.,

Having compiled a novel Chart or Map illustrating the various

CHEMICAL PRODUCTS DERIVED FROM COAL AND COAL TAR,

in the form of a Genealogical Tree, including all the products discovered to date (the total number amounting to near 700), offers for sale a limited number of copies in Colors, mounted on Linen, with Rollers. Price, $3.50. Orders may be sent to

A. M. CALLENDER & CO., - - No. 32 Pine Street, New York.

ISBELL-PORTER COMPANY,

G. G. PORTER, Prest. (Successors to SMITH & SAYRE MFG. COMPANY) CHAS. W. ISBELL, Secy.

ENGINEERS AND CONTRACTORS FOR THE

Construction and Extension of Gas Works.

Special Castings, Tees, Bends, etc.
Bench Castings.
Water Gas Generators.
Hydraulic Mains.
Iron Floors.
Brenner Self-Sealing Retort Lids.
Tar Gates and Hydraulic Main Dip Regulators.
Hutchison's Tar Displacement Apparatus.
Multitubular Condensers.
Standard Washer-Scrubbers.
Tower Scrubbers.
Walker's Tar and Carbonic Acid Extractors.
Exhausters.
Engines.
Steam Jet Exhausters.
Exhauster Governors.
Compensators.
Self-Acting Bye-Pass Valves.
Valves.
Valve Stands with Indicators.
Purifying Boxes.
Purifier Valve System.
Center Seals.
Street Governors.

Estimates, Drawings and Specifications Furnished for the Alteration, Improvement, or Extension of Existing Works or the Construction of New Works.

ISBELL-PORTER COMPANY,

No. 245 Broadway, New York City.

GAS WORKS APPARATUS AND CONSTRUCTION. GAS WORKS APPARATUS AND CONSTRUCTION.

JAMES R. FLOYD & SONS,
(SUCCESSORS TO HERRING & FLOYD)
Oregon Iron Works,
W. 20th & 21st. Sts., bet. 10th & 11th Avs.,
NEW YORK CITY.
Engineers and Contractors
FOR THE
CONSTRUCTION OF GAS WORKS.
MANUFACTURERS OF
All Kinds of Castings and General Ironwork
FOR
GAS APPARATUS.
Bench Castings, Regenerative and Half Regenerative Furnace Castings.
Condensers, Scrubbers, Purifiers, Street Drips and Connections,
Valves,
Hydraulic Hoisting Purifier Carriage, Self-Sealing Retort Lids, Improved Valve Stand and Indicator, Seller's Cement.
Plans, Specifications, and Estimates furnished for Construction of New or Alteration of Old Works.

Bouton Foundry Co.,
FOUNDERS AND MACHINISTS,
CHICAGO, ILL.
Gas Works Apparatus,
PURIFIERS, CONDENSERS,
Bench Work
SPECIALS. LAMP POSTS,
SCRUBBERS,
Iron Roofs and Floors.
Plans and Estimates furnished for new works or extensions of old works.

H. Ransham, Pres. & Mangr. Wm. Stacey, Vice-Pres. T. H. Birch, Asst. Mangr. R. J. Tarvin, Sec. & Treas.
STACEY MFG. CO.,
MANUFACTURERS OF
Single and Telescopic Gasholders,
IRON ROOFS, BRIDGES, LAMP POSTS,
Water and Oil Tanks, Coal Elevator Cars,
COKE CRUSHERS, BENCH CASTINGS,
And all kinds of Wrought and Cast Iron Work used in the erection of Coal and Oil Gas Works. Rolling Mill Machinery and Heavy Castings a Specialty.
Foundry: 33, 35, 37 & 39 Mill Street. Wrought Iron Works: 16, 18, 20, 22, 24 & 26 Ramsey Street.
Cincinnati, Ohio.

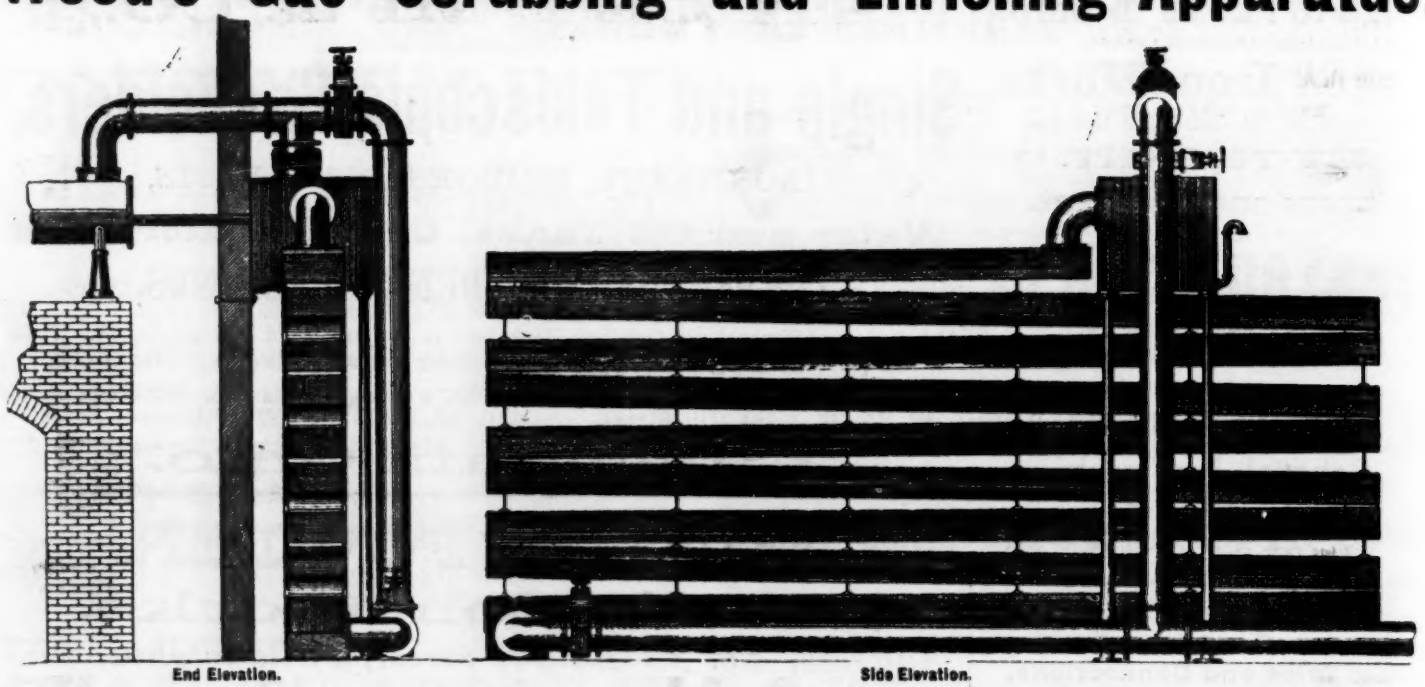
1842. DEILY & FOWLER, 1893
Laurel Iron Works.
Address, No. 39 Laurel Street, Philadelphia, Pa.
BUILDERS OF
GASHOLDERS,
Single and Telescopic.
Holders Built 1886 to 1892, Inclusive

Galveston, Texas. (3d.)	Malden, Mass.	Lancaster, Pa. (3d	Oakland, Cal.	So. Bethlehem, Pa. (2d)
Fort Plain, N. Y.	Paducah, Ky.	Tacony, Pa. (two)	Central Gas Lt. Co., New York City (2d)	"Vassar College," N. Y
Brunswick, Ga.	Norwich, Conn.	Mount Vernon, N. Y.		So. Chester, Pa.
Port Chester, N. Y.	Seattle, W. T.	Binghamton, N. Y.	Tacoma, Wash.	Cumberland, Md.
New Rochelle, N. Y.	San Diego, Cal.	Concord, N. H.	Knoxville, Tenn.	Auburn, N. Y.
Salem, N. J. (3d)	Westerly, R. I.	Dover, Del. (2d)	Pottstown, Pa.	DesMoines, Ia.
Omaha, Neb. (2d)	Northern Gas Lt. Co., of New York, N. Y.	Calais, Me.	Victoria, B. C.	Brooklyn, N. Y.
Lynn, Mass. (2d)		New London, Conn. (2d)	Vancouver, B. C.	Washington, D. C. (2d)
Little Rock, Ark.	Willimantic, Conn	West Chester, N. Y.	Charlottesville, Va.	Wilkes-Barre, Pa.
Irvington, N. Y.	Montclair, N. J.	Bay Shore, L. I.	So. Framingham, Mass.	Bridgeport, Conn. (2d)
South Boston, Mass.	Attleboro, Mass.	Washington, D. C.	Woonsocket, R. I.	Sing Sing, N. Y.
Rye, N. Y. (2)	Santa Cruz, Cal.	Newport, R. I. (2d)	Simcoe, Can.	Exeter, N. H.
Staten Island, N. Y. (2d)	Erie, Pa. (2d)	Morristown, N. J.	Pittsfield, Mass. (2d)	Wilkes-Barre, Pa., ons
Woodstock, Ont.	West Chester, Pa. (2d	Lebanon, Pa.	Chattanooga, Tenn. (2d)	Lynn, Mass. (2d) [Gas Co

ILLUMINATING GAS! FUEL GAS!
The Loomis Process.
Now in successful operation at Works of John Russell Cutlery Co., Turner's Falls, Mass., and Henry Disston's Sons' Saw Works, Tacony, Pa.
The Cheapest Gas Generating System in the World.
Plans and Estimates Furnished.
BURDETT LOOMIS, - - Hartford, Conn.

WM. HENRY WHITE,
No. 32 Pine Street, - - - New York City.
ENGINEER AND CONTRACTOR FOR THE
ERECTION AND EXTENSION OF
GAS, WATER, AND ELECTRIC LIGHT WORKS.
Correspondence with Gas Companies contemplating extending or improving their Plants respectfully invited
Plans and Estimates Furnished.

Wood's Gas Scrubbing and Enriching Apparatus.

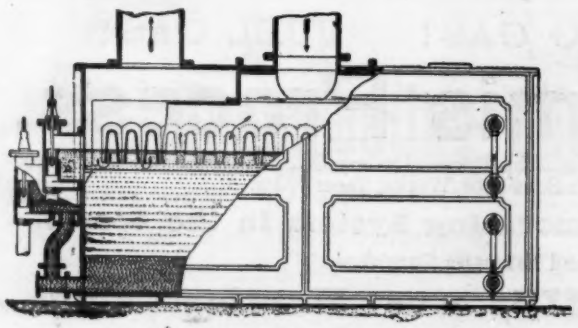


End Elevation. Side Elevation.

The cheapest, simplest, and most effective apparatus for removing Tar and Ammonia, and enriching Gas, ever brought to the attention of Gas Manufacturers. With ordinary condensers and scrubbers the condensable illuminants flow off to the tar wells and liquor tanks and are lost, but with Wood's Apparatus these illuminants are saved and retained in the gas, thus increasing its illuminating power and making a great saving in the cost of enriching material. Where set up next after the Hydraulic main, this Scrubber produces an 8-oz. Ammoniacal Liquor.

JAMES R. FLOYD & SONS, - - Nos. 531 to 543 West 20th Street, N. Y. City.

THE WALKER TAR AND CARBONIC ACID EXTRACTOR.



Built by ISBELL-PORTER CO., 245 Broadway, N. Y.

More than **300** in Use.

REMOVES ALL THE TAR AND A LARGE PART OF THE CARBONIC ACID.

Ask the Brooklyn Gas Company, the Bridgeport Gas Co., the Brookline Gas Co., the Nassau Gas Co., the Providence Gas Co., the Trenton Gas Co., and a number of others which we can't name for want of space, if IT won't.

GEORGE SHEPARD PAGE'S SONS,

Sole Agents. **69 Wall Street, New York.**

FIELD'S ANALYSIS

For the Year 1892.

An Analysis of the Accounts of the Principal Gas Undertakings in England, Scotland, and Ireland. Being the Twenty-third Year of Publication. Compiled and Arranged by

JOHN W. FIELD, Accountant to the Gas Lt. and Coke Co., London.

Price, $5. For Sale by

A. M. CALLENDER & CO., - No. 32 Pine Street, N. Y. City.

GAS AND WATER PIPES.

P. D. WANNER, Chairman. A. H. MELLERT, Mangr. of Wks.
R. B. KINSEY, Secretary. F. A. KNOPP, Treasurer.

MELLERT FOUNDRY & MACHINE CO. Ltd. and READING FOUNDRY CO., Ltd.

Reading, Pa.

Specials—Flange Pipe, Valves and Hydrants Lamp Posts, Retorts, etc.

General Foundry and Machine Work.

JOHN FOX, Selling Agent **160 Broadway, N.Y.**

THE OHIO PIPE COMPANY,

MANUFACTURERS OF

Cast Iron Gas & Water Pipe,

BRANCH AND SPECIAL CASTINGS.

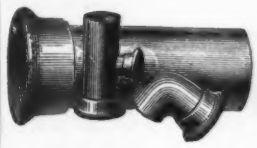
Gas-House Bench Castings, Hydraulics, Lamp Posts, Flange Pipe and Specials, Architectural Castings, Building Columns, Joists, Cellar Grates, Sash Weights, etc.

GENERAL FOUNDERS AND MACHINISTS.

Columbus, Ohio.

GAS METERS.

WARREN FOUNDRY AND MACHINE CO.



Established 1856. Works at Phillipsburgh, N. J.

New York Office, 160 Broadway.

CAST IRON WATER AND GAS PIPE,

FROM THREE TO FORTY-EIGHT INCHES DIAMETER. ALSO, ALL SIZES OF

Flange Pipe for Sugar House and Mine Work. Branches, Bends, Retorts, etc., etc

---

M. J. DRUMMOND,

SPECIAL CASTINGS AND LAMP POSTS.

Office, Corbin Building, 192 Broadway, N. Y.

EMAUS PIPE FOUNDRY.

DONALDSON IRON COMPANY. EMAUS, PA

MANUFACTURERS OF

CAST IRON PIPE AND SPECIAL CASTINGS

FOR WATER AND GAS.

THE ADDYSTON PIPE AND STEEL COMPANY,

CAST IRON.

PIPE.

CINCINNATI, OHIO.

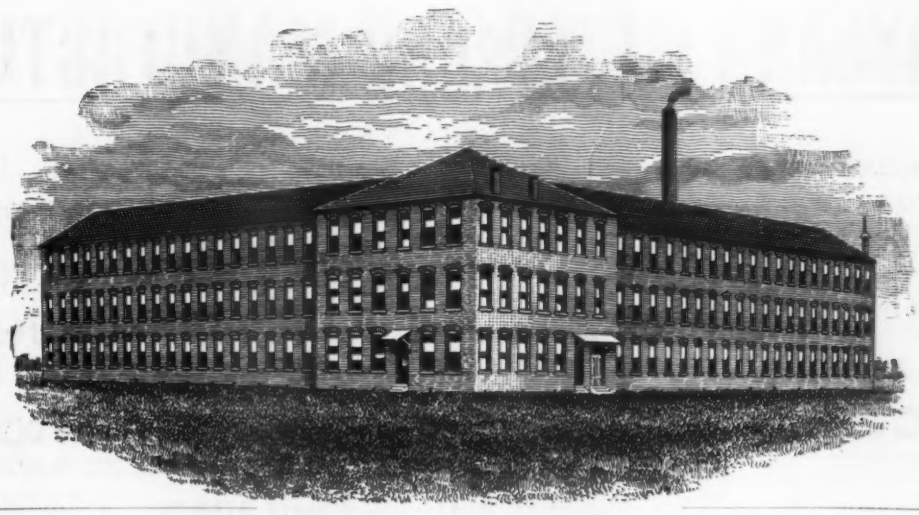
Purifiers, Condensers, Scrubbers & Center Valves

SPECIALS, FLANGE PIPE, AND LAMP POSTS.

C. N. PAYNE, Prest.

J. B. WALLACE, Supt.

F. H. PAYNE, Sec. and Treas.



Factory and Office

ERIE, PA.

ESTIMATES FURNISHED ON APPLICATION.

Agency,
McELWAINE-RICHARDS CO.,
62 & 64 W. Maryland St., Indianapolis, Ind.

METRIC METAL CO.,

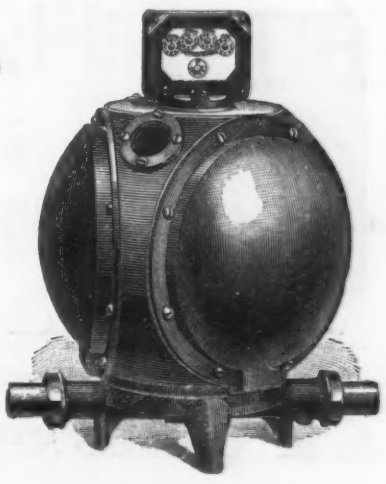
MANUFACTURERS OF

Dry Gas Meters

FOR ALL KINDS OF SERVICE.

Special Attention Paid to REPAIRING METERS OF ALL MAKES.

G. M. WITHERDEN, Agent.



JOHN J. GRIFFIN & CO.,

Nos. 1513, 1515, 1517 & 1519 Race Street, PHILADELPHIA.
No. 52 Dey Street, NEW YORK. No. 75 North Clinton Street, CHICAGO.

MANUFACTURERS OF

METERS FOR MEASURING GAS

IN ANY VOLUME.

Provers, Gauges, Registers, Etc., Etc.

EXPERIMENTAL APPARATUS FOR QUANTITATIVE AND QUALITATIVE ANALYSIS.

Careful and Prompt Attention paid to Repairing of all kinds of Meters and Apparatus.

Estimates Cheerfully Furnished.

Established 1849.

With the best facilities for manufacturing, is enabled to furnish reliable work and answer orders promptly.

NATHANIEL TUFTS,

153 Franklin St., Boston, Mass.

C. W. HINMAN, - - Manager.

MANUFACTURER OF

DRY GAS METERS.

Station Meters of any Capacity.

Test and Experimental Meters, Pressure Registers, Pressure Gauges.

METER PROVERS, PHOTOMETERS, STREET LANTERNS, ETC., ETC.

Apparatus for the Chemical Testing of Gas and Gas Liquor.

CHARLES E. DICKEY. JAMES B. SMALLWOOD. CHARLES H. DICKEY.

THE MARYLAND METER AND MANUFACTURING CO.

Established 1866.

BALTIMORE, North & Saratoga Sts. **CHICAGO, 122 & 124 Michigan St.**
NEW YORK, 838 Broadway. **SAN FRANCISCO, 221 Front St.**
BOSTON, 92 Water Street, Rooms 21 and 22.

CONSUMERS' & STATION METERS, PRESSURE GAUGES, Etc., Etc.

"Success" and "Perfect" Gas Stoves.

Established 1849.

HARRIS BROS. & CO.,

Twelfth and Brown Streets, Phila., Pa.

Agency, 67 & 69 S. Canal Street, Chicago.

Manufacturers of Wet and Dry Gas Meters,

STATION METERS, METER PROVERS,

EXPERIMENTAL METERS, SHOW OR GLAZED METERS,

Pressure and Vacuum Registers, Gauges, Photometers, Drip and Bell Pumps, Etc., Etc.

PROMPT ATTENTION GIVEN TO ALL ORDERS. METERS THOROUGHLY REPAIRED. ESTIMATES FURNISHED FOR STATION METERS OF ALL SIZES. CORRESPONDENCE SOLICITED.

GAS METERS. GAS METERS. GAS METERS.

WM. N. MILSTED, Prest. and Genl. Supt. WM. H. HOPPER, Vice-Prest. PAUL S. MERRIFIELD, Sec. and Treas.

THE AMERICAN METER CO.

Established 1834. Incorporated 1863.

WET AND DRY GAS METERS. PRESSURE REGISTERS. METER PROVERS.
STATION METERS. PRESSURE & VACUUM REGISTERS. PORTABLE TEST METERS.
EXHAUSTER GOVERNORS. PRESSURE & VACUUM GAUGES. EXPERIMENTAL METERS.
DRY CENTER VALVES. CRESSON GAS REGULATORS. AMMONIA TEST METERS.
GOVERNORS FOR GAS WORKS. MARSLAND WATER METERS. BAR & JET PHOTOMETERS.

Manufactories:
512 West 22d St., N. Y.
Arch & 22d Sts., Phila.

GAS STOVES.
SUGG'S "STANDARD" ARGAND BURNERS,
SUGG'S ILLUMINATING POWER METER,
Wet Meters, with Lizar's "Invariable Measuring" Drum.

Agencies:
380 Main Street, Cincinnati.
125 & 127 S. Clinton Street, Chicago.
810 North Second Street, St. Louis.
222 Sutter Street, San Francisco.

HELME & McILHENNY,

(Established 1848.)

GAS METER MANUFACTURERS,

Nos. 1339 to 1349 Cherry Street, Philadelphia, Pa.,

WET AND DRY GAS METERS, STATION METERS, EXPERIMENTAL METERS, METER PROVERS,

Center Seals, Pressure Registers, Governors, Indicators, Photometers, and all other kinds of Apparatus for use in Gas Works

FOULIS' PATENT STATION AND DISTRICT GOVERNORS.

REPAIRING DEPARTMENT.—We employ a special force of skilled workmen repairing meters of **all makers.**

D. McDONALD & CO.,

Established 1854.

154 West 27th Street, NEW YORK CITY.
51, 53 & 55 Lancaster St., ALBANY, N. Y.
34 & 36 W. Monroe St., CHICAGO, ILL.

MANUFACTURERS OF

Wet and Dry Gas Meters

STATION METERS, EXPERIMENTAL METERS, METER PROVERS, PRESSURE & VACUUM REGISTERS & PRESSURE GAUGES.

Meters of all makers Thoroughly Repaired.

A CONVENIENT

BINDER for the JOURNAL.

STRONG.
DURABLE.
LIGHT.
SIMPLE
CHEAP.
HANDSOME.
Price, $1.

A.M. Callender & Co., 32 Pine st., N. Y. City

The American Gas Engineer and Superintendent's Handbook.

By WM. MOONEY.

850 Pages, Full Gilt Morocco. Price, $8.00.

A M. CALLENDER & CO., 32 Pine St., N. Y.

W. WALLACE GOODWIN, Prest. CALEB G. RIDGWAY, Vice-Prest. & Treas. CHARLES PAIST, Sec. H. B. GOODWIN, Supt. & Gen'l Mangr.

THE GOODWIN METER CO.,

1012, 1014 & 1016 Filbert Street, Philadelphia, Pa.

Agent, GEORGE B. EDWARDS, 113 Chambers Street, N. Y. City.

SOLE MANUFACTURERS OF THE

"Sun Dial" Gas Stoves,

IN A GREAT VARIETY OF STYLES AND SIZES.

Gas Cooking Stove No. 7 C.

The Most Economical, Efficient, and Durable Gas Stove Made.

SIZE.

Stove.	*Oven.*	*Broiler.*	*Top.*
31 inches high.	9½ inches high.	10 inches high.	21 inches high.
17 inches wide.	15 inches wide.	15 inches wide.	16 inches wide.
	12½ inches deep.	12½ inches deep.	
	Length over extension shelves, 32 inches.		

This Stove has three Boiling Burners in the Top or Hot Plate, and single Oven Burner.

The consumption of this Stove is 35 cubic feet per hour, at 1½ inch pressure with all burners.

Three-eighth inch supply pipe should be used when the pressure is 1½ inches or over.

ALL FITTINGS ARE NICKEL PLATED.

Catalogue showing Styles and Prices sent free on application.

DRY and WET GAS METERS

Station Meters (square, cylindrical, or in staves), Glazed Meters, King's and Sugg's Experimental Meters, Lamp Post Meters, etc., etc.

METER PROVERS (Sizes 2, 5 and 10 feet.)

Pressure Gauges of all kinds, Pressure Registers, Pressure and Vacuum Registers, Pressure Indicators (sizes 4, 6 and 9 in.), King's Pressure & Vacuum Gauges.

DRY & WET CENTER SEALS, DRY & WET GOVERNORS, EXHAUSTER GOVERNORS.

Photometers of all descriptions. Letheby's Sulphur and Ammonia Test Apparatus Complete.

Also, TESTING AND CHEMICAL APPARATUS OF ALL KINDS, AND OF THE MOST PERFECT DESCRIPTION, FOR ALL PURPOSES RELATING TO GAS.

GOODWIN'S IMPROVED LOWE'S JET PHOTOMETER.

Special attention to repairs of Meters and all Apparatus connected with the business. All work guaranteed first-class in every particular. Orders filled promptly.